FOOD AND DIGESTION

IN

HEALTH AND DISEASE

KIMPTON'S PUBLIC HEALTH SERIES

FOOD AND DIGESTION

IN

HEALTH AND DISEASE

DURING

INFANT, CHILD, AND ADULT LIFE

WITH AN INTRODUCTION ON

THE NATURE OF MATTER AND THE PHENOMENA OF LIFE AND AN ACCOUNT OF THE SOURCE, PROPERTIES AND INFLUENCE OF

WATER

BY

M. A. DUTCH, M.D.

Diplomate in Public Health and Sanitary Science, University of Cambridge; Fellow of the Royal Institute of Public Health, London, etc., etc.

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HENRY KIMPTON
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PREFACE

THE subject of food and its influence on man has in every age attracted more attention than any other branch of Hygiene, though it has seldom been treated in anything like a full manner, except by the authors of large text books on dietetics, for many of the smaller books extant are devoted to the purpose of either promulgating special doctrines or recommending certain régimes. I trust, therefore, I am justified in submitting this little treatise to notice, and as I have used my best efforts to give as unbiassed an account, and as accurate and widespread a survey, as space would permit, of the principles which govern "Food and Digestion in Health and Disease," I hope it may merit some favourable attention and supply a want which I think to be needed.

I have further thought well, in view of the difficulty of conveying a fairly accurate and useful knowledge of the chemical processes concerned, to include an introductory chapter which refers to the "Nature of Matter" and the "Phenomena of Life." Indeed, it is perfectly

futile for one to hope to acquire a logical conception of the physiological changes which persist in the body, so long as human existence prevails, unless, at least, a rudimentary study is made of these subjects. To facilitate the correct interpretation of the technical terms I have used, in the sense I desire; and to add to the educational value of that which I have written, I have also included a short glossary. This I trust may be found of service not only to Nurses, and those whose duties bring them into association with invalids, but also to others interested in the subject of "Public Health."

LINDEN HOUSE,
197 WALM LANE,
CRICKLEWOOD, N.W.
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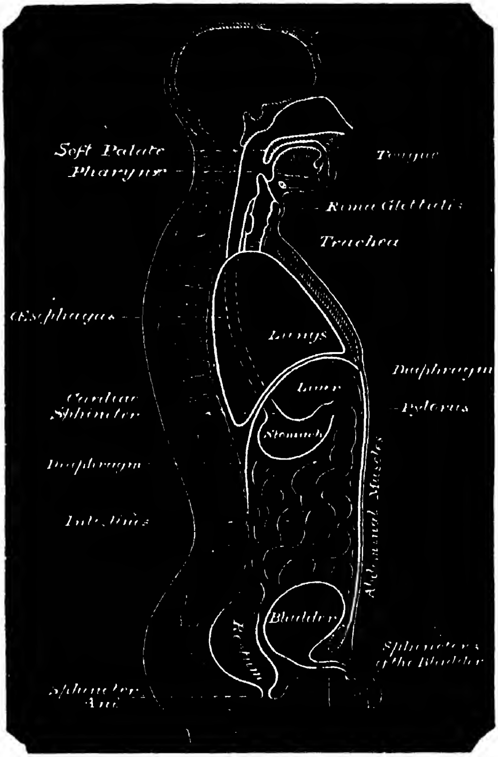

DIAGRAM OF THE ALIMENTARY CANAL AND RESPIRATORY TRACT.

(From Kirke's Physiology.)

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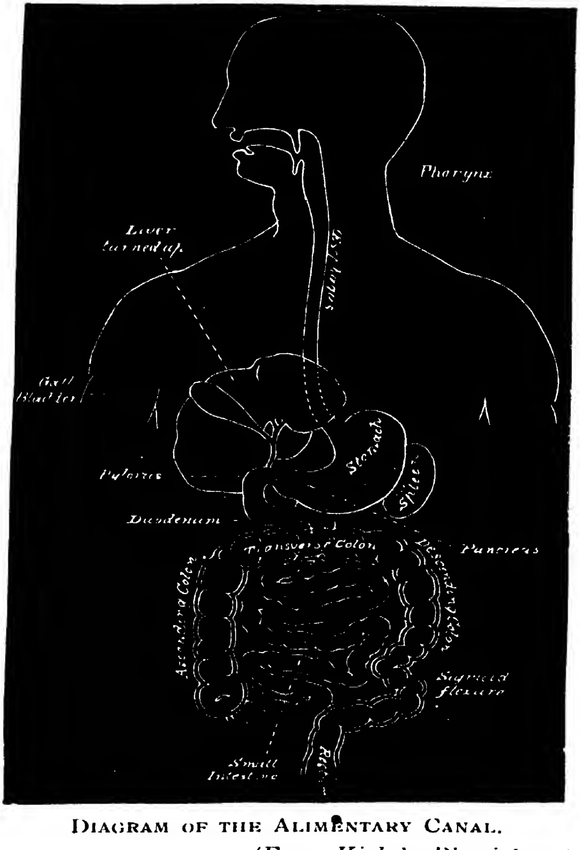

DIAGRAM OF THE ALIMENTARY CANAL.
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FOOD AND DIGESTION.

CHAPTER I.

INTRODUCTORY.

Section I.—The Nature of Matter.

To appreciate the influence of Food and Digestion upon human existence, it is essential that some of the rudimentary facts concerning the nature and properties of matter should be understood.

ELEMENTS.

By chemical analysis scientists have been able to separate most of the substances found in nature into distinctly different bodies, from which nothing of a different nature has yet been obtained. These component parts, or atoms of matter, are termed *Elements*. And, all matter, whether it be living, or dead;

animal, vegetable, or mineral; solid, liquid, or gaseous, is composed of one or more of these elements. When elements combine with each other they form complex, or *Compound Bodies*, and when they exist in a free state or alone, they form *Simple Bodies*. It has further been demonstrated mathematically that atoms of matter are composed of infinitely small particles, or corpuscles, charged with electricity, termed *Electrons*.

CHEMICAL COMBINATION.

Elements which possess the most unlike properties combine best; and an element existing in a state of combination, with another, will leave such combination, if an element for which it has a greater affinity be introduced into the compound.

CHEMICAL ACTION.

When elements combine to form compounds, or compounds separate to form simple bodies, Chemical action ensues.

An alteration in the nature, and property of a substance, is the invariable result of chemical action. The process is, however, also attended by phenomena, of which, perhaps, the generation of *heat* and *light* are the most common. The

following changes, too, are of very frequent occurrence.

1. The conversion of solids to liquids and gases, and of gases to liquids and solids.
2. The conversion of colourless into coloured substances, and of coloured into colourless.
3. The conversion of poisonous into non-poisonous bodies, and of non-poisonous into poisonous.
4. The conversion of tasteless into tasteful substances, and of tasteful into tasteless.
5. The conversion of odourless into odoriferous substances, and of odoriferous into odourless.
6. The conversion of soluble into insoluble material, and of insoluble into soluble.

There is in fact no finality to the endless series of change which chemical action induces, and most of the laws which govern human existence, and the nature of matter, are based on its effects.

To artificially start chemical action, the application of heat to raise the temperature, or the addition of a liquid to dissolve the elements to be brought into combination, is

often necessary; as, in lighting a match, and adding water to a seidlitz powder.

To comprehend how common the changes mentioned are, one has but to consider:—In the simple operation of every day cooking, solids are converted into gelatinous, liquid, and gaseous substances; that vinegar changes the colour of steel ware; and, that food becomes putrid and poisonous if kept too long.

The more violent indication of chemical action is evidenced by the terribly explosive force of gunpowder, nitroglycerine, and other such like compounds; the component elements of which, are in such loose combination or affinity, that the slightest force, or heat, causes them to fly asunder and combine with other elements in a more cohesive and stable state. And the *light*, *heat*, *force*, and *smoke*, of an explosion, are all manifestations of the *chemical activity* which changes gunpowder, or any other high explosive, into *elements* and *compounds* of an entirely different nature.

As to the conversion of *poisonous into non-poisonous bodies*, and vice versâ, it is interesting to note that some elements which are quite harmless to human life, either separately or

when combined in certain proportions, and may indeed be indispensible to its existence, are virulently poisonous when combined in certain other proportions.

For instance, though the element *carbon* is an innocuous one, and we should eat 5000 grains of it each day in our food, and the element *oxygen*, which is present in the air, is so essential to the continuance of life, that, deprived of it, we could but live a few minutes, and we absorb 10,000 grains of it for our requirements in 24 hours, yet, a very few grains of carbon and oxygen, combined in equal atomic proportions, form Carbonic Oxide (CO); a gas fearfully destructive to life, and to which many deaths have unfortunately been due. The most recent notable one being that of the ever to be lamented and noble-minded Zola.

On the other hand, when one atom of Carbon combines with two atoms of Oxygen, Carbon Dioxide gas (CO_2) is formed, and this gas is ever so much less dangerous to life. As a matter of fact, the air we breathe always contains it, for the Oxygen of the air we inspire combines with the Carbon of the food we ingest, and adults expire from their lungs into

the air 13,500 grains of it during every 24 hours of life. This Carbonic Acid Gas in the presence of sunlight, and chlorophyl or the green colouring matter of leaves, serves, as the food for plants with which to build up their structures; and the heat to which its formation in the human body gives rise, maintains the temperature or animal heat of our bodies, which persists whilst life lasts, and never falls or rises in healthy human beings much above or below 100° Fahrenheit.

Weight.

Chemical action does not alter weight, for the weight of a substance is equivalent to the weights of the elements which compose it, and vice versâ.

This has been frequently proved and demonstrated in many ways. A well known experiment is to burn a candle away in a specially constructed apparatus, so that the carbon, gases, and other products of combustion can be collected and weighed, when the combined weights of collected products of combustion are invariably found to be exactly the equivalent of the original weight of the

candle used, if an allowance be made for the increase of weight due to the Oxygen of the air consumed in the burning.

This experiment also supports—so far as we can prove—the truth of the theory respecting the "Conservation of Matter," which maintains that "Nothing is ever lost in Nature," or that "Matter is Indestructible."

Number of Elements.—*Seventy-eight elements* have been discovered, and their properties more or less studied and elucidated; and, under ordinary conditions, fifty-eight are metals and twenty non-metals. It may appear incredible to some that so few bodies can constitute everything of which this planet is composed; but, reflection will convince that the number of different compounds the elements can form are infinite. For instance, a more limited alphabet than there are known elements, could spell a greater number of articulate combination of sounds than all the people who have ever lived or will ever be born could utter, and similarly the seventy-eight elements could combine to form more compound bodies or substances than this world could hold. Never-

theless, I do not desire to convey, nor do I believe, that many other elements do not exist, for scientific research is certain in time to discover many others; and, it is also most probable, that many of the bodies which we now believe to be elementary, or simple substances, are really compound ones. There can be no doubt, however, that the bulk of the Earth, Air, and Sea, is composed of those bodies which we at present regard as Elements.

The following are the *principal elements* concerned in the constitution of the human body, and which comprise the bulk of everything found in nature,—whether it be animal, vegetable, or mineral; liquid, solid, or gaseous.

GASES	INTERMEDIATE	METALS
Oxygen	Carbon	Potassium
Hydrogen	Sulphur	Sodium
Nitrogen	Phosphorus	Calcium
Chlorine	Iodine	Magnesium
Fluorine	Silicon	Aluminium
Argon	Bromine	Iron

THE COMPOSITION OF PURE AIR PER 100 VOLUMES IS :—

Oxygen	20·94
Nitrogen	78·40
Argon	·63
Carbonic Acid	·03

THE COMPOSITION OF THE EARTH PER 100 PARTS IS OF

Oxygen	50	Calcium	3·5
Silicon	25·3	Magnesium	2·5
Aluminium	7·3	Sodium	2·3
Iron	5	Potassium	2·2

The proportion of none of the other known elements exceeds ·3 per cent.

THE CHEMICAL COMPOSITION OF THE BODY OF A MAN WEIGHING 154 lbs. IS OF

	lbs.	ozs.	grs.
Oxygen	111	0	0
Hydrogen	15	0	0
Nitrogen	3	9	0
Carbon	20	0	0
Sulphur	—	2	117
Phosphorus	1	12	190
Calcium	2	0	0
Fluorine	—	2	0
Chlorine	—	2	382
Sodium	—	2	116
Iron	—	—	100
Potassium	—	—	290
Magnesium	—	—	21
Silicon	—	—	2

Vegetable life is the medium by which the chemical elements which constitute the earth's crust are transferred and transposed into living animal tissues. For the elements of which

plants are composed (dissolved in rain water) are absorbed by their roots from the soil; and, in the presence of sunlight and green colouring matter, by their leaves from the air: and whether man be a vegetarian, or partakes exclusively of the flesh of animals (which of course must live directly or indirectly on the produce of the soil), the tissues of his body are alike built up of the same elements which are found to pervade and compose the Earth upon which he stands, and the oceans of Sea and Atmosphere which surround him.

When compound matter disintegrates or is disintegrated by the action of the omnipresent *microbes* which feed on it, *oxygen* which consumes or burns it, and *water* which dissolves it, the constituent elements which compose it, ultimately again combine, according to their chemical affinity, to form, as stated, the structures of plants, and later still of animals. Thus the never ceasing change in the constitution of the universe; the metamorphosis of the dead to the living and the living to the dead; and, the indestructible interdependent bonds of connection between the animate and the inanimate, has existed from the beginning,

and will continue to the end of knowable time.

For a full account of the clements, I must refer the reader to special manuals which treat upon chemistry; but that the educational value of this small work may not altogether be lacking in this respect, and that its perusal may be an incentive to further study, I have appended a short account of the *principal elements* which are connected with the chemical changes in the living body, and which constitute the bulk of The Universe.

Hydrogen.—Symbol H.—Atomic weight 1.

Hydrogen was discovered by Paracelsus, in the 16th century; and at the ordinary temperature and pressure of the atmosphere is a colourless, tasteless, and invisible gas.

The atoms which compose it are very light, and the weight of an atom of hydrogen is the unit taken for estimating that of other elements.

A given quantity of hydrogen is, volume for volume, nearly sixteen times lighter than oxygen, and about fourteen and a half times lighter than air. Hence, for inflating balloons aeronauts use it in preference to other gases.

When hydrogen and oxygen gas are introduced into a suitable apparatus, in the proportion of two atoms of the former to one of the later, and an electric current is discharged through them they combine with each other, and become united and condensed into a volume of *water* which only occupies but $\frac{1}{1870}$th part of the space filled by the original gases. Water can also be decomposed into its elementary constituents, hydrogen and oxygen. The chemical symbol, or shorthand, to express the term water is, (H_2O).

If a lighted taper be dipped into a jar of hydrogen it is extinguished, but if it be applied to its edge where the hydrogen is escaping an explosion takes place, so forcible is the union between the hydrogen and the oxygen present in the air:—And as a light will not burn in an atmosphere of hydrogen, a man could not exist in one. Hydrogen enters into the formation of nearly all substances, for water is practically omnipresent.

Nearly ninety per cent. of the weight of vegetable substances and two thirds of the weight of the human body is composed of water. It is present in the soil and in the air,

and it covers the greater part of the surface of the globe. The body of a man, weighing 154lbs., contains about 15lbs. of hydrogen, and it enters into the formation of every tissue of his substance.

Oxygen.—Symbol O.—Atomic weight 16.

Oxygen is the most wide-spread of all the elements, and was discovered by Priestly in 1774, A.D.

It is a colourless, tasteless, odourless and invisible gas, at the ordinary pressure and temperature of the atmosphere. The atoms which compose it are nearly 16 times heavier than hydrogen and about one tenth heavier than air. So a balloon inflated with oxygen gas would not ascend. Three quarters of the weight of the terraqueous globe is composed of it. It forms about one-fifth the volume of the atmosphere; eight ninths by weight of water; and is present in nearly all substances. The body of a man weighing 154lbs. contains 111lbs. of oxygen.

Oxygen combines with nearly all elements, and does so, with manifestations of *light* and *heat*, when the affinity or chemical combination

is sufficiently forcible. The process of the union of oxygen with other elements is, hence, termed *combustion*, or oxidation.

A taper which is nearly extinguished bursts into a bright flame when plunged into a jar of oxygen gas; and many metals which will not burn in the air (owing to the diluted state of the oxygen present), do so freely, in an atmosphere of pure oxygen.

A candle is mainly made up of animal fat, and chemical action is started by lighting it, for the hydrogen and carbon of which the fat is principally composed combine with the oxygen of the air and form with it Carbonic Acid (CO_2), and Water (H_2O). In a similar way, the oxygen of the atmosphere, when drawn into our lungs, oxidises the tissues of our bodies and generates animal heat, and we exhale Carbonic Acid, and Watery vapour, from our lungs. Hence an atmosphere, which will not support combustion, or in which a candle will not burn, is fatal to man. Oxidation is therefore practically the fundamental factor which underlies every manifestation of life; and whether its influence is exerted inside or outside the living body the chemical changes it causes are

much of the same nature: and when oxidation ceases within the living blood stream, life becomes extinct, and the heat of the body falls to that of other surrounding objects possessing similar capacities for heat.

Spontaneous Combustion of the body does not occur, because the heat produced by oxidation is spread over the whole body, and the heat at any one spot is not great enough to cause ignition. Many instances though of people being burnt alive would nevertheless lead to the conclusion that, under certain conditions, the human body becomes more inflammable; and cases are recorded of confirmed *alcoholics* being practically calcined in a few hours. There can, however, be scarcely any doubt but that, in the first instance, they must have accidentally set themselves alight.

In cases of inflammation, when parts become red and hot; in conditions of starvation, and in exhausting diseases, when the tissues of the body are burnt away, for lack of food or fuel, the influences of oxidation become very evident. So essential is a proper supply, that the amount of oxygen present in the atmosphere, which varies from about 18% in coal mines, to

21% out at sea, is in direct ratio to the health of an individual, or a community. And good health cannot be maintained unless air contains nearly 21% of oxygen per volume.

Vegetation, Wind, Rain, and Universal Cleanliness increase—and the reverse conditions lessen—the proportion of oxygen in the atmosphere.

Ozone.—Symbol O_3.—Atomic weight 48.

Ozone is a condensed form of oxygen, and though discovered as far back as 1839, its true nature is still in doubt. As, however, it can be generated by passing discharges of electricity through air, its presence must wholly or partly be connected with certain electro-chemical conditions of the atmosphere.

Ozone is a colourless and invisible gas, possessing a characteristic smell, which may be perceived, even when it is diluted by 2½ million volumes of air. It is a powerful oxidiser, and thus readily burns up all putrid materials (upon which the microbes of disease flourish), and, like oxygen, oxidises nearly every known element.

Very little, if any, ozone is found in the

atmosphere of filthy overcrowded localities; (for it has been used up), but, in the open country, in proximity to forests, on mountain tops, and, more notable still, by the sea, it is more abundantly present. Therefore all conditions which favour the purity of the atmosphere, are productive of the presence in it of an increased amount of ozone, and hence of oxygen too.

Nitrogen. — Symbol N. — Atomic weight 14·04.

Nitrogen was discovered by Rutherford in 1772, A.D. It is a colourless, tasteless, invisible gas. It is present, in a free state, in the atmosphere, of which it forms over 78% per volume. It does not support combustion, for a candle is extinguished by being plunged into a jar of it; and life cannot be preserved by breathing it. It is present in the atmosphere to dilute the oxygen, and thus prevents the tissues of the body being too rapidly burnt away. It also, however, serves other important purposes, as food for plants etc., not yet fully understood.

Nitrogen, in combination with other elements,

enters into the formation of the tissues of all animal and vegetable substances; and it is essential to every function of the body, and manifestation of life.

Nitrogen may be separated from the atmosphere by burning a piece of the element Phosphorus in a bell jar, containing air, the lower part of which is immersed in water. On ignition, the *phosphorus* combines with the *oxygen* of the air present (the resulting fumes of which are dissolved by the water, which rises in the jar one-fifth higher) and *nitrogen* is the principal gas left in the space unoccupied by the water.

Argon.—Symbol A.—Atomic weight 39·9.

Argon is a gas which exists in the atmosphere in the proportion of about ·63 per cent. Its presence was first suspected by Cavendish in 1785, but attracted no further notice till 1884 when Lord Rayleigh and Sir Wm. Ramsay discovered it.

Argon is two and a half times heavier than air; it cannot be made to combine with other elements, and its true purpose has not been yet elucidated.

Carbon.—Symbol C.—Atomic weight 12.

Carbon is found in nature as the *diamond*, *graphite* and *charcoal;* and, though these substances differ greatly in appearance, all are alike composed of carbon; for, on burning them separately in an atmosphere of pure oxygen, carbonic acid gas (CO_2) is formed in each instance. Coal is but charcoal or the bituminised remains of ancient forests.

Carbon, as in the case of nitrogen, enters into the formation of all animal and vegetable tissues. It is, as previously stated, with the carbon ingested as food that the oxygen of the air inhaled combines to produce animal heat, and the carbon di-oxide or carbonic acid gas (CO_2) expelled by the lungs into the air.

By a wise dispensation of providence, this poisonous gas, in the presence of sunlight and green colouring matter, is rendered harmless by plants which split it up again by absorbing its carbon to convert into starch wherewith to form their fibres and structures; and, set free its oxygen again into the atmosphere to be utilised to support all life by night and day, and all plant life by night alone.

Phosphorus.—Symbol P.—Atomic weight 31.

Phosphorus is a combustible, yellowish, semi-transparent, waxy-looking substance, and does not exist in a free state in nature. Combined with lime, it is the principal constituent of bone (of which it forms 60%).

Phosphorus is also necessary to sustain the functions of the brain and nervous system, and its partial absence from the human body is characterised by soft, and bowed, rickety bones, stunted growth, mental weakness, and a general condition of impaired vitality.

Calcium (Lime)—Symbol Ca.—Atomic weight 40·1.

Lime is present in the earth, and combined with carbon and oxygen, as a carbonate or *chalk*, forms great mountain ranges, and coral reef formations. Its presence in these strata is due to the earthy or mineral remains of microscopic and other animals which flourished in prehistoric times of incomputable antiquity. Lime is present in the tissues of animals and plants; and the human body of a man weighing 154 lbs. contains about 2 lbs, which, in com-

bination with phosphorus and other elements gives firmness and solidity to the skeleton and tissues.

Sodium.—Symbol Na.—Atomic weight 23·05. Sodium is an element which does not exist in nature in a pure metallic state, but, in combination with chlorine is known as common salt. It can be obtained from sea-water, and salt-rock, and by burning marine plants. Soda is present in the bodies of all animals and vegetables, and is wide-spread through the air.

The human body of a man weighing 1·54 lbs. contains about 2 oz.; it is essential to the functional activity of the blood and all the organs and tissues of the body.

Potassium. — Symbol K. — Atomic weight 39·15.

Like the metal sodium, potassium does not exist in a pure metallic state in nature. It may be obtained as a carbonate, by burning land vegetables and plants. Potassium contributes principally to the functions of the muscular tissues; and the body of a man weighing 154

lbs. contains a little more than half an ounce of it.

Iron.—Symbol Fe.—Atomic weight 55·9.

Iron, as an oxide, or hematite, exists as large deposits in the earth, and is present in the bodies of animals and in plants. The body of a man weighing 154 lbs. contains about a 100 grains of it (sufficient to make a small signet ring), combined with other elements. The colour of the fluids and tissues of man is due to the iron contained in them, for it is the iron which gives colour to the blood. The iron in the blood, by its chemical affinity for oxygen, unites and carries it with it from the lungs to all parts of the body ; and, hence, its partial absence from the blood, as in cases ot anæmia, is well known to cause shortness of breath, and other evidences of a deficient supply of oxygen to the tissues.

Sulphur.—Symbol S.—Atomic weight 32·06.

Sulphur, in combination with other elements, such as arsenic, copper and iron, as an ore is plentifully distributed in nature. Sulphur is essential to the formation of the tissues of

animals and plants; and the body of a man weighing 154 lbs. contains about 2 ounces of it.

The foregoing incomplete account of the best known elements quite exhausts the space I have allotted for their consideration; nevertheless, I trust, I have dwelt sufficiently upon them to render more intelligible much of that which will be found hereafter written upon the subject of Food.

On analysis, the body of a human being weighing 154 lbs. is composed of :—

	lbs.	ozs.
Oxygen	111	
Hydrogen	15	
Nitrogen	3	9
Carbon	20	
Minerals or Salts ...	4	7

These elements, when combined, form the compound substances or *Proximate principles* of which the tissues of the organism are made up, thus :—

			lbs.	
1.		Water	111·0	which is composed of Hydrogen and Oxygen.
2.	Proteids	Gelatin	15·0	which are composed of much *Nitrogen* and less carbon, hydrogen, oxygen sulphur, phosphorus, etc.
		Albumin	4·3	
		Fibrin	4·4	

3. Carbons	Fats	12·0	which are composed of much *Carbon* and *Hydrogen* and less nitrogen, oxygen, sulphur, and phosphorus, etc.
4. Minerals	Salts	7·3	which are composed of iron, soda, potash, lime, magnesia, etc., and the remainder of the oxygen, nitrogen, hydrogen, and carbon.

The above four proximates are distributed as follows :

(1.) **Water** is present in every tissue and organ, and constitutes nearly the entire volume of every fluid in the body. The following table indicates the percentage of total weight of the body, which the different specified organs represent, and the percentage of water they contain.

	Per cent. total weight of body.	Per cent of water.
Bones	16·0	8
Muscles	41·0	83
Chest organs	1·7	70
Abdominal organs ...	7·2	70
Fat	18·2	30
Skin	6·9	72
Brain	1·9	75

Thus about two thirds of the entire weight of the body is entirely composed of water.

(2.) **Nitrogen** is principally represented by gelatin, albumin, and fibrin, though it is not entirely absent from any tissue or fluid.

Gelatin is found in the muscles, *Chondrin* in the cartilages and tendons, and *Albumin* and *Fibrin* in the blood, muscle juices, and fluids of the body. Indeed, some nitrogenous compound enters into the constitution of every tissue of the body, and all the secretions and excretions of the organism contain it, for it is indispensable to every act and function of life.

Vegetable albumin and fibrin and other nitrogenous compounds, differing but little from those of animal origin, are likewise present in, and essential to plant life and development.

(3.) **Carbon.**—The carbon present in the body, as indicated, is the principal element which forms the fat, though it, like nitrogen, is also omnipresent.

Carbon, too, is essential to vegetable life, growth, and development; for it and water constitute nearly the entire structure of all plants.

(4.) **Salts** are present in every part of the body.

Lime phosphate and other salts constitute 67% of the weight of bone.

Soda is found everywhere, but particularly in the blood.

Potash is largely present in muscular and other structures.

Iron gives colour to all tissues and fluids, and is the means whereby the oxygen of the air is carried by the circulation to all parts of the body.

Now as Carbon, Nitrogen, Salts and Water are essential to the maintenance of *life*, *growth*, and *development*, we shall later on enter more particularly into the processes by which these materials are adapted for human requirements.

Section II.—The Phenomena of Life.

The alchemist of ancient time who classified Earth, Air, Water, and Fire, as the only elements in nature, believed the bodies of living things to be of a peculiar substance, which did not possess any elementary parts. In so far, however, as we at present know and have studied, all matter is composed of one or more of the seventy-eight elements, and that, "Dust thou art, and shalt to dust return," truly exemplifies

the cycle of human, animal, and vegetable life as divulged to us.

Though matter may differ thus but little, if at all, in its elementary composition, it certainly does in function, and hence living and dead matter differs immeasurably.

When matter is referred to as *Organic*—that which pertains to the organs of animals or plants is expressed; and when *Life* is spoken of, that state of an animal or plant in which its organs are capable of performing vital functions, is meant.

The chief characteristics of animal life are :—

1. The capacity to move *with an object.*
2. The power to assimilate nourishment, and discharge waste and used up material.
3. The capability to grow and multiply.

All life results from a pre-existing form of life, and if an organism differs from the form which preceded it, the change is due to "EVOLUTION," or the persistence by reason of "NATURAL SELECTION" of only those Species best adapted to battle against adverse conditions or surroundings, or to accommodate themselves to their "ENVIRONMENT." This potent truth is amply manifest to all who

study the matter, for few biologists now deny that the phases of human and animal types, both in form and character, distributed all over the world, are due to evolution; or that the doctrine of Darwin respecting the "Survival of the Fittest," which embodies the theory of evolution, is a correct one.

In support of the theory that the influence of natural selection can result in the diminution of some faculties no longer essential to life, and the development of others more needed—all must admit that man by subjugating the brute creation to his behests, has by human selection bred domesticated animals to develop those qualities most serviceable to his requirements, and altered their form and character as compared with their prototypes.

Again, by the scientific agricultural method of adapting a soil to a selected seed, or vice versâ, and cultivating under suitable conditions of heat and moisture, vegetable life can be more approximated to perfection. And what is even more remarkable still, and may be conclusively proved:—the very lowest forms of life known, comprised in the class of micro-organisms which produce disease, can be similarly *evolved*,

the harmful being made to generate harmless, and the harmless harmful species, if the surrounding conditions or *Environment* be favourable to such change.

Indeed, the modern principle of curing and preventing a disease by inoculating with the microbes, which, under ordinary circumstances would cause it, is based on the knowledge of how to cultivate and grow these organisms in accordance with the recognised laws of evolution, by which they are deprived of their virulent properties.

Though the higher types of animals and plants possess characters at once distinctive, the lowest types are so similar in appearance and function that it is impossible definitely to detect where the one ends and the other commences—for both are developed from an undifferentiated speck of substance composed of the same elements, the principal ones of which are:—Hydrogen, Oxygen, Nitrogen, Carbon, Sulphur, Phosphorus and Salts.

The term *Protoplasm* is applied to this substance, and it is the material of which every living thing is composed, and by which every form of life is sustained and propagated.

Cells.

The term cell was originally applied by botanists to the specks of protoplasm, of which they saw, by the microscope, vegetable structures were made up. They also discerned that these protoplasmic specks contained green colouring material (chlorophyl) and were surrounded by a ring or wall of denser material (cellulose) or starch, and were the true atoms of vegetable life. Histologists, who were interested by these researches, soon discovered that similar cells built up and formed the component parts of all living creatures, though they differed from vegetable cells in not possessing so definite a cell wall and being devoid of chlorophyl.

Life.

To understand the vital properties possessed by *animal cells*, the functions of the smallest one celled animal yet discovered has been carefully studied.

When one of these little organisms, known as an *Amœba*, is examined on the slide of a microscope it is seen :—

1. To exhibit spontaneous purposive move-

ments, or to move about by shooting out projections of protoplasm (which act like "false feet" or little oars) and to retract them if irritated by mechanical or chemical methods.

2. To possess the power of digesting or assimilating nourishment, by flowing round and engulfing food.

3. To grow and multiply :—For sometimes these cells are seen to enlarge and divide into two separate beings.

Vegetable cells are endowed with some of these attributes, but they neither move about, nor do they engulf their nourishment—which is circulated round their cell wall to nourish their protoplasmic centre. They, however, multiply by division, and do so with such astounding rapidity that a common mushroom develops 60 million cells a minute.

Now the cells which compose the bodies of animals and man, also develop from a single animal cell or protoplasmic speck, which (like an *amœba*) grows and divides and subdivides *ad infinitum* throughout life from its inception. Such cells become *specialised*, and perfectly adapted to discharge certain functions to the

exclusion of others; for cemented together by intercellular material they form the fibres or threads which nature weaves into the *different* tissues which compose the body. Thus:—Skin, fat, muscles, bones, nerves, blood vessels, and all the other tissues which contribute to form and life are created; and the vital functions of movement, circulation, respiration, digestion, excretion, growth, and reproduction, etc., are carried on by organs, which are *specially constructed of particular cells adapted for such purposes.*

The living cells of which the organs are built, however, decay and die in myriads of millions during each minute of life, and were it not for the fact that they are exactly and coincidently reproduced and replaced, the wear and tear of existence would soon dissipate the body.

The *specialised function* possessed by the different cells of the body enables them to absorb from the blood streams, the exact elements required for their reproduction, growth, and multiplication; and, therefore the hair and the nails grow again when cut, and in a like manner throughout life, every tissue of the body

wears out and is reproduced over and over again.

The superabundant and exhausted elements and dead cells which have served the purposes of life, are discharged again into the blood stream; and are separated from it by cells whose special function is to purify the body by clearing out of it all waste and poisonous matter—and in this way the cells which form the skin, kidneys, lungs and intestines eliminate the excretions harmful to life.

I do not desire to make any attempt to explain why a cell composed of known chemical elements should become endowed with life or how it does so; or to theorise and philosophise upon the apparently simpler problem of why heat will quicken potential into active existence—as in the case of hatching an egg in an incubator, or growing a plant from a seed which perhaps has lain dormant for ages—for the simple reason that it would be futile for me to do so, as it could not serve any useful purpose to speculate upon an enigma which is, and in my humble opinion, ever will be, above the mental capacity of man to solve.

CHAPTER II

The Anatomy and Physiology of Digestion.

DIGESTION.

DIGESTION is the term applied to the process by which ingested food is chemically and otherwise changed, and prepared for the nutrition of the body, so that it may support animal heat, minister to the never ceasing waste, and supply material for the growth and reproduction of the human organism.

Briefly—in the mouth, the food we take is triturated, masticated, and ground up by the combined action of the teeth, tongue, and cheeks, and incorporated with saliva. It is then swallowed and forced down the gullet, by its contractions, into the stomach, where it is churned up and mixed with the gastric or stomach juice, and converted in chyme, or a

buttermilk-like fluid. The *chyme* now leaves the stomach and enters the intestines to be mixed with the bile and the pancreatic and intestinal juices, which convert it into *chyle*.

The chyle, which represents most of the essential principles the food orginally contained, digested and adapted for absorption, passes into the *lacteals*, and through them into the *abdominal glands* where it is further elaborated, previous to its entering the *thoracic duct*, which passes along the side of the spinal column and enters a vein, situated at the left side of the neck, which carries blood and the nutriment poured into it to the heart. From the heart this fresh supply of nourishment, to form new blood, is propelled and circulated round and throughout every part of the body to maintain its integrity and sustain its functions.

The undigested and indigestible constituents of diet are propelled by the contractions of the intestines into the lower bowel from whence they are extruded as *Fæces*, by the combined action of voluntary and involuntary muscular efforts.

THE MOUTH is the cavity between the jaws, inclosed by the cheeks and lips, which opens behind into the *fauces* and *pharynx*; and is sepa-

rated from the nasal cavity, by the hard palate in front, and soft palate behind; its floor being formed by the tongue.

The cavity, floor, and roof of the mouth are lined or covered by mucous membrane (a very thin sensitive skin) which is continuous down and through the entire alimentary canal, and into the mouth ducts or tubes open to empty saliva and mucous secretions.

THE TONGUE is a prehensile organ composed of muscles (or flesh). It is richly supplied with nerves which communicate stimuli of taste and feeling to the brain, and carry the mandates from the brain for it to move.

DENTITION.

The "milk" or temporary teeth commence to "cut" through the gums, at about the age of six months; and first dentition is complete at about the age of two and half years. When completed 20 teeth in all are present.

At about the age of seven years, these temporary teeth commence to be shed, and gradually give place to the permanent set of 32, which in time, completely replace them. At the age of 25 years this second dentition is at an end.

A TOOTH is made up of a crown and a fang (or fangs) through which nerves and blood vessels pass into its pulp cavity, which is contained between these structures.

A section of a tooth examined under the microscope, or chemically analysed, is similar in appearance and composition to an ordinary section of bone. The crown is, however, covered by a material not usually found in bone, called *enamel*, which is the hardest substance found in the body, and one of the hardest known to occur in nature.

THE SALIVARY GLANDS.

The Salivary Glands are the organs which separate the necessary materials from the blood wherewith to form the saliva.

They are six in number and are arranged in pairs, situated at either side of the face, and under the lower jawbone.

These glands are composed of a number of little cells bound together in little lobules, by blood vessels, nerves, and fine tissues. The lobules empty their contents into small tubules, which ultimately unite together to form a duct, through which the saliva is passed into the mouth.

Saliva is nearly entirely composed of water, with a little salt, and nitrogenous matter, and it owes its great use to the presence in it of the digestive ferment *ptyalin*. About 2 pints of saliva, containing 12 grns. of ptyalin, is secreted each day by an adult.

Uses of Saliva.

1. The *Ptyalin* converts the indigestible starchy elements of vegetable food into digestible sugar.

(The saliva of an infant, under the age of six months, does not contain ptyalin, and for this reason farinaceous and starchy foods are unsuitable for its nutrition.)

2. It keeps the mouth moist, and facilitates speaking, eating, and swallowing.

3. It dissolves substances, and thus contributes to taste and nutrition.

When food has been sufficiently masticated and insalivated, and has had its starch converted into sugar, it is pressed by the tongue against the palate, and forced into the pharynx and gullet. The soft palate during the act of swallowing guards against food entering the

aperture of the nostrils; and the epiglottis, or small leaf-like cartilage connected with the back of the tongue, covers over the larynx and likewise protects the wind-pipe and lungs from the entrance of fluids and solids into them.

The Gullet or Œsophagus.

The Gullet which conveys the food to the stomach from the pharynx, is a muscular tube nine inches in length, which passes along the left side of the neck into the chest, behind the lungs, and opens through the diaphragm (midriff or great muscle, which separates the chest from the abdominal cavity) into the left and upper border of the stomach (cardiac orifice).

The Stomach.

This is the most capacious part of the digestive tract, and when fairly distended holds about 2½ pints of fluid. It is 12 inches from side to side, and 4 inches from its upper to its lower border which projects somewhat below the front of the arch of the ribs.

The outlet of the stomach (pyloric orifice) is guarded by a valve or fold of membrane, for the purpose of preventing undigested lumps of food passing onwards.

The stomach is composed of 4 coats :—

1. a strong fibrous covering.
2. a muscular coat.
3. a loose layer of tissue.
4. a lining of mucous membrane.

The mucous membrane of the stomach has a velvety appearance, which is bright in colour, when digestion is active, and pale when it is quiescent; and on close examination, it is seen to be mapped out into shallow, honey-comb shaped depressions, into which the ducts of the glands, which secrete the gastric juices, empty their contents.

Gastric Juice.

The part played by the stomach, in the digestion of food, is to secrete gastric juice and to incorporate it thoroughly by the action of its muscular coat, with the food ingested.

In chemical composition, gastric juice contains approximately 994·5 parts of water, and 5·5 parts of solids in every 1000. A pint of gastric juice contains about 27 grains of *Pepsin*, 1¾ grains of *Hydrochloric acid*, and 30 grains of salts of soda, potash, lime, magnesia, and iron.

It is due to the acid and the pepsin of the gastric juice, that the food, which enters the

stomach, is digested and converted into the thick, whitish, curdled, butter-milk-looking mass, called chyme. For, in the presence of acid, the pepsin acts vigorously upon the *albuminous* proteid substances contained in such animal and vegetable foods as meat, milk, eggs, bread and oatmeal, and converts them into digestible *peptones*, which are capable of passing into the system to sustain it.

The gastric juice also dissolves substances which have escaped digestion by the saliva, and it is an *anti-septic* agent too. Indeed, were it not for this latter property, disease due to the ingestion of poisonous food would be more frequent than it is.

Gastric digestion usually takes about 4 hours to complete, if the stomach be not over distended with very indigestible material, and if its function be not disturbed by violent exercise of either body or mind.

The amount of gastric juice secreted per day is estimated to be about 15 pints.

As food is being *chymified* and digested it is moved gently onwards and backwards by the contractions of the muscular coats of the stomach, and when this process of digestion is

completed, the *pyloric* valve opens and allows the fully formed *chyme* to enter the small intestines, but keeps back undigested food until it is suitably prepared to pass onwards by closing against it.

The Intestines.

The intestines, which extend from the stomach to the outlet of the lower bowel, are about 25 feet in length, and are divided into two principal parts, *large* and *small*, separated by a valve, which permits the products of digestion to pass in the one direction only, from the small to the large intestine.

The Small Intestine is a tubular canal about 20 feet in length, and is similar in structure to the stomach.

The mucous membrane which lines the intestinal canal is arranged, nearly throughout its whole length, in ridges round its circumference, for the purpose of:—First, assisting to mix the intestinal digestive juices with the chyme, to convert it into *chyle;* secondly, to prevent the chyle from passing further on in an unchanged condition; and, thirdly, to present a larger surface for the absorption of the fluid products of digestion. It is also thickly studded

over by myriads of little depressions or *follicles*, which secrete digestive juices, and by velvety projections or *villi*, through which the *chyle*, containing fully digested elements of food, enters the system through the lymphatic vessels, glands, and thoracic duct.

Each Villus is capped over by cells continuous with those which cover the lining membrane of the intestines, and is composed of a *lacteal* tube, surrounded by muscular tissue, blood vessels, and connective tissue.

Beneath the mucous membrane too are placed innumerable little glands which are endowed with special digestive functions.

The Large Intestine is similar in structure to the small intestine, and it also is studded with glands and follicles. The valve which separates it from the small is formed by a folding in of the mucous or lining membrane of the intestines strengthened by muscular fibres. Close to this valve is the *Appendix*, which is a small tube with a closed end, and is the seat, very frequently, of the disease known as appendicitis. It is placed in the lower right side of the abdomen, just above the situation of the bend of the thigh.

Digestion in the Intestines.

The chyme from the stomach, when it enters the intestines, is acted upon by the secretions of the Liver, Pancreas, and Intestinal glands, and converted into *chyle*.

The Pancreas or "Sweetbread."

This is a large gland, 6 or 8 inches long and 1½ inches wide, situated across the upper part of the abdomen behind and under the lower margin of the stomach, midway between the end of the breast bone and navel. It is composed of cells bound together by fine connective tissues and of blood and lymphatic vessels.

The cells of the Pancreas, which secrete the pancreatic digestive juice, are bound together to form lobules, which empty their contents into little ducts which all coalesce to form one large one. This, the pancreatic duct, enters the uppermost part of the small intestine.

The Pancreatic Juice

is a colourless sticky fluid, containing 975 parts of water and 25 parts of solids in every 1000.

Its great digestive activity is due:—

1. To the presence in it of a ferment called *Trypsin*, which converts the *albumin* which has escaped the action of the gastric juice into *peptone*.

2. To the property it possesses of changing *starch*, which has escaped the action of the saliva, into *sugar*.

3. To being able to split up *fat* chemically and to *emulsify* it.

THE LIVER.

The liver is the largest gland in the body. It is 3½ lbs. in weight, 9 inches broad, 7 inches long, and 3 inches thick; and occupies the upper part of the abdominal cavity, beneath the midriff. It is encased by the chest walls and ribs, and extends from right to left, and its lower right border in health, just reaches to about the level of the costal arch or margin of the right lower front ribs.

The liver is a very vascular organ, being richly supplied with blood. The portal veins which carry blood back to the heart from the intestines and elsewhere, traverse it, and the hepatic artery also supplies it with blood. Indeed, it is due to the portal veins entering it,

that diseases of the liver so often derange the functional condition of the intestines, and vice versâ.

The liver in structure is composed of lobules one twentieth of an inch in diameter, made of cells, which separate from the blood the elements wherewith to form *bile*. The lobules aggregated together form lobes, from which ducts coalesce and pass to the gall bladder.

The gall bladder is a pear-shaped bag attached to the under surface of the liver, lined by mucous membrane and covered by elastic and fibrous coats. The broad end of the gall bladder projects at the front margin of the liver, just beneath the right arch of the ribs, and its narrow end is continuous with the *cystic* duct, which empties its contents into the upper part of the small intestines through the *common bile duct*.

Functions of the Liver.

1. To effect further changes in the peptone, formed by the digestive activity of the gastric and intestinal juices upon albuminous or proteid foods.

2. To further chemically change the sugar, into which the starchy elements of food have

been converted, into *glycogen*, and to store it for a time, to serve the purposes of nutrition as required. (The disease *diabetes* is due to a failure of this function, and in consequence, sugar passes out of the body through the kidneys in great quantities. And it is for this reason a non-starchy diet is often imperative in such cases.)

3. *To secrete bile.*

The bile which the liver secretes is stored in the gall bladder, and poured from it through the cystic duct which enters the upper part of the small intestines. The flow of bile into the intestine is continuous, though it is more actively discharged into it, immediately after food has been taken, and just before the time has arrived for another meal.

The amount of bile secreted by the liver is increased by the ingestion of albuminous food, and varies from one to nearly two pints per day.

Bile is usually yellowish or greenish in colour, and of bitter taste, and is composed of 850 parts of water and 150 parts of solids in every 1000.

The solids are chiefly composed of soda, salts, mucus, and colouring matter.

The uses of Bile.

1. It acts as an anti-septic, and thus diminishes putrefaction of the intestinal contents.

2. It lessens the acidity of the chyme, as it is alkaline.

3. It dissolves fatty acids, and assists in the digestion and absorption of all the products of digestion.

4. It is nature's aperient.

When the bile has discharged its functions, the greater part of it is again absorbed into the circulation to be carried into the liver, where the cells again remake and utilise it to secrete a fresh supply.

As all the blood in the body passes through the liver twice during every minute of life, it can be readily understood why its derangement is such a frequent source of illness.

The Absorption of Food.

We have seen that, from the moment food enters the mouth, until the undigested portions

of it leave the body, chemical changes, by means of ferments, and other agents, are continually acting upon the *proteid*, *starchy*, *fatty*, and *saline* elements of which it is composed, to fit it for absorption into the blood stream, from which the living cells of the tissues of the body assimilate the materials necessary for the continuance of their functional activity. We shall now briefly review the whole process.

WATER.

To a very small extent indeed is water absorbed by the blood vessels, which ramify in the mucous membrane of the mouth, fauces, and gullet, though it is freely removed by the cells of the stomach and intestines and transferred by them to the blood stream.

SUGAR.

Malt sugar, into which the starchy part of food is converted by the saliva, is further changed into grape sugar by the intestinal juices, and the living cells which cover the lining of the intestines, and it is picked out by them and transferred to the blood stream to be stored up as *glycogen* in the liver, and as fat in the tissues of the body.

Peptone.

Peptone into which the albuminous element of food is converted, by the digestive juices, is reconverted into albumin, by the cells of the mucous membrane lining the intestines, and thus enters the blood stream already further elaborated and made more suitable to build up tissue again. When this reconversion is not effected by the cells, and peptone enters the system unchanged, blood poisoning and illness is the consequence. In this way perfectly sound food may often prove most harmful, when the living cells lining the alimentary canal are perverted by disease or injury and cannot discharge their function.

Fats.

The emulsified products of the digestion of fats are picked out of the chyle by the cells which cover the villous projections scattered over the mucous membrane of the intestines, and transferred by them and other cells into the lacteal vessels which they surround.

These lacteal vessels coalesce and form a fine network with each other, and ultimately empty their chyle into a reservoir which is situated at the front part of the spinal column

at the level of the navel (*Receptaculum Chyli*) from whence the *Thoracic duct*, which is about the size of a goose quill and passes into the chest, behind the lungs, carries the chyle to the subclavian vein (situated at the left side of the neck), which returns blood to the heart.

The Fæces.

The fæces are principally composed of the undigested and indigestible constituents of food and living organisms, and the products of chemical change and decomposition. Bile is also present in a small quantity, and the debris of the wear and tear of the intestinal lining membrane can also be detected in the material excreted from the lower bowel.

Though an adult consumes, on the average, 23 ozs. of dry food a day, but 2 ozs. of dry fæces are passed by the bowel. And this proves how thoroughly solids are dissolved, digested, absorbed, and assimilated, to sustain the vital activities of the body, and illustrates the perfect and co-ordinate functional precision with which every physiological process is effected in health.

CHAPTER III.

Animal Heat and Nutrition.

Food.

As food is our source of animal Heat, Energy, and Nutrition, the subject of it requires careful consideration to appreciate its influence for good and evil upon the human body.

Animal Heat.

Food is really fuel, and man, in common with all living creatures whose life is sustained by the absorption of oxygen from the atmosphere, possesses, within himself, a source of heat which, during life, is virtually independent of surrounding conditions.

If food be placed in a furnace, to which the air has access, and ignited, it will boil water, the steam from which may be utilised as the energy to drive machinery: and food burnt inside the human body, by the oxygen of the

air (absorbed by the iron of the blood, in its passage through the lungs) is productive of the heat or the energy to accomplish work.

In precisely the same way as the blacksmith fans the flame of his fire by pumping air with a bellows through his coke dust, human beings keep the torch of life alight by the activity of their lungs.

The amount of heat generated in the body depends upon the combustible qualities of the fuel or food ingested, and upon the activity of the vital functions; for, the digestive processes pour food into the blood stream prepared for oxidation or combustion; and the respiratory acts draw air into the lungs, from which the blood absorbs the required amount of oxygen, to circulate through the body.

About one pound and a half of oxygen is inspired from the air each day by the lungs of a healthy adult, which, having served the purpose of oxidation, or combustion, to support the heat of the body, is mostly expired again combined with the carbon, and other burnt up waste products of combustion, as carbonic acid (CO_2) and other poisonous gases, and combined with hydrogen as watery vapour.

The heat of the blood in health (as estimated near the surface of the body) is always about 100° F. The temperature registered is lower in the mouth, and lower still (98.4° F) in the arm-pit.

Climate and season affect the temperature of the body but slightly. It is, however, lower in the early morning (at about 3 a.m.) when the vital functions are least active, than in the afternoon when they are most so.

Babies and *young children* breathe more rapidly than adults, and, therefore, their temperature is usually slightly higher too. And as the nervous system is more sensitive during infancy and childhood than in adult life, very trivial ailments often cause sudden and considerable variations of temperature in young people.

A temperature above 106° F. is usually fatal, and a temperature of about 101° F. calls for early attention.

Though the human body is subject to the same laws as all heated bodies, i.e., gives off heat when the surrounding objects are colder and receives heat when they are warmer. Nevertheless, as stated, the heat of the body may be, and is usually, maintained at a constant

level by ingesting more *food*, taking more *exercise*, and wearing warmer *clothing*, if the environment be colder, and by reversing these measures if the environment be warmer.

Consequently, those unable to obtain proper and sufficient food suffer terribly from the cold, and, hence, the unfortunate starving, ill-clad poor are so often frozen to death in winter.

Even though the food supply be ample, it will not burn well, if its digestion is imperfect, or if the lungs are not acting properly : and for this reason, many well fed people continually complain of feeling the cold of winter unduly ; and travellers overtaken by storms perish of cold if, instead of persisting in the exercise of their limbs and lungs, they give way to the torpor of drowsiness.

When the system is surfeited with food, and the waste poisonous materials, due to its imperfect combustion, *Exercise* and *Abstinence* are the only natural methods to adopt to burn them away and obtain relief.

Energy and Work.

A Calorie is the measure of heat required to raise 1lb. of water 4° Fahrenheit—the mechanical

equivalent of which is, to lift a 1lb. weight 1400 feet high. It has been estimated that on complete combustion :—

1 oz. of	Proteid food	is equivalent	to	116	Calories.
,,	Starch	,,	,,	116	,,
,,	Fat	,,	,,	265	,,

The heat evolved per day by the combustion of food in the body of a healthy adult is calculated to be equivalent to 3500 Calories or that heat which would generate sufficient steam and power, to lift a ton weight 4000 feet high, (termed 4000 foot tons) or to raise $5\frac{1}{2}$ gallons of water from freezing to boiling point. This is about the heat that would be given off during the burning of a pound of coal.

The greater part of the heat generated (about $\frac{6}{7}$ths) is, however, required to afford the power necessary to sustain the vital functions of the internal organs, and only 350 foot tons is available for the external work of the body. This is about the energy expended by a pavior each day at his labour.

Based on the above calculation :—A man weighing 150 lbs, (about one fifteenth of a ton) should be able each day to lift his own body

(350 × 15) 5250 feet, or climb up a perpendicular ladder ($\frac{5250}{3}$ft. = 1750 yds.) about a mile in length.

Twenty times less energy is expended in walking at the rate of 3 miles an hour than when climbing a perpendicular ladder, and therefore, a properly fed, healthy adult should be competent to walk twenty miles a day, or accomplish as much other work as the labour of such a task would entail.

As walking at the rate of 4, 5, or 6 miles an hour necessitates a rapidly and geometrically increasing expenditure of energy for each additional acceleration of mile speed, exhaustion soon supervenes. So truly, "'Tis the pace that kills," and steady plodding accomplishes more work than ill-sustained spurts of activity, physical or mental.

It is interesting to note that the analogy between a locomotive and a human being, as regards external work, also in a great measure holds good. For a locomotive only utilises about $\frac{1}{10}$th of the potential energy produced by the combustion of the fuel placed in its furnace, and though a human being can utilise more than this, still the proportion of energy, which is generated by the combustion of the food re-

ceived into the stomach, available for external work, is but $\frac{1}{7}$th of the whole. Further, in the expenditure of energy for external work by a locomotive, each acceleration of speed necessitates a rapidly increasing output of force, and a geometrically increasing amount of coal to effect it, and when its speed limit or capacity to bear strain is exceeded a break-down results. Similarly, a human being can only exert his energies within the limit of his capacity for work, and each additional effort, as that limit is approached, necessitates a continuously increasing output of force and strain upon his system, until at last when it is exceeded his vital energy becomes exhausted and a break down results.

Of course the above explanation is only intended in a figurative sense, for, from an economical standpoint, there is scarcely any comparison whatsoever between the work of God and the work of man; for, as stated, the energy unused by man for external work is utilised for the vital internal activities of his body, whereas the energy not utilised in propelling the locomotive is practically all wasted. In addition to which also, in respect of with-

standing STRAIN, the human body is infinitely more perfect than the locomotive; for a man can for short periods ("spurts") do ten times the amount of work, or, what is the same thing, bear ten times the strain for which he is normally adapted, whereas the boiler of a locomotive bursts when its normal capacity is exceeded.

BRAIN WORK.

It is hard to compute the exact relationship which exists between brain work and manual labour, in respect of loss of energy.

Judged, however, by the effect of close mental concentration on the quantity of nourishment brain workers need to sustain their mental powers, there is no doubt, that though the exercise of the intellect is far more exhausting than that of the body, students need less food than manual labourers, and of a more digestible variety.

Young children, in particular, are soon exhausted by mental efforts, and are but too often irreparably injured by the over-pressure to which they are subjected.

Drowsiness, forgetfulness, inattention, inaccuracy, irritability and depression, are the

danger signals of "Brain fag," which young and old alike exhibit when their brains are exhausted by over-work or anxiety.

The alarming increase, year by year, of mental invalids who claim care and attention, is probably quite as much the result of a too early, and faulty system of education, as it is of the gradually increasing stress of competition experienced in adult life by those who are obliged to work for a living.

Nutrition.

In addition to supplying the fuel for the generation of heat and energy, food also affords the *nutritive* material required for the Growth, Development, and Reproduction of the body.

We know, by oxidation, the substance of the body is being continually burnt away, and yet in health, its weight varies but little from day to day, so perfectly is this loss made good.

Though every thought and act is attended by the activity and destruction of myriads of living cells, yet the equilibrium of the body is maintained by the development of others; for all parts destroyed are coincidently and exactly reproduced, as the cells or vital atoms which,

woven into threads, form the different tissues of the body, possess the inherent faculty of being able to absorb from the blood stream the precise elements they require for their development and reproduction. Thus hairs and nails grow when cut or worn away, and similarly, in the lapse of time, all other parts of the body are likewise removed and replaced.

The generally believed doctrine, as to a complete change in the constitution of the body being effected every seven years, is therefore not quite devoid of a scientific basis.

Results of Defective Nutrition.

A human being, deprived of *food* and *water*, wastes and dies, when reduced forty per cent. in weight, and life is seldom prolonged beyond a period of 10 days.

Therefore in the case of a man weighing 150 lbs. starving to death—60 lbs. would be the equivalent of this 40 per cent. loss of weight in 10 days; and six pounds, his daily loss. Of this 6 lbs. 4 lbs. would be eliminated as water, and 2 lbs. as carbon, nitrogen, and salts, by the skin, lungs, kidneys, intestines and other organs of the body.

The changes which would occur in the starving body would first be evidenced by the disappearance of its fat; and then its blood would be reduced to one quarter of its volume (by loss of water).

The digestive organs and the heart would next waste, and lastly the brain and nervous system would suffer, and delirium and convulsions would end the scene.

The foregoing account of how "waste exceeds repair," and how the body "eats itself up" when deprived of food, unequivocally proves that a man, under ordinary circumstances, even to sustain life requires to digest at the *very least 2 lbs. weight of cooked food* each day, and conclusively establishes the absurdity of people supposing that it is possible to enjoy health and vigour on a few ounces of food only.

CHAPTER IV.

Classification of Food.

The chief chemical compounds or Proximate principles in food are :—

Proteids Carbohydrates Fats	organic
Salts Water	inorganic

Proteid or nitrogenous food forms flesh and muscle, and is essential to the vital function of every cell in the body.

Carbohydrates form the fatty structures which protect, keep warm, store up fuel, and give shape to the body.

Fats or hydrocarbons are mostly utilised for the immediate generation of animal heat.

Salts give firmness to the tissues, consolidation to the bones, colour to the blood, and active chemical properties to the fluid secretions of the body.

Water:—The human body is composed two thirds by weight of water, and every tissue owes its properties to it. It is the principal constituent of the blood whereby oxygen and nutrient material is carried to, and poisonous waste is removed from every part of the organism. Its solvent action on food, and its presence in the digestive secretions, contributes essentially to the sense of taste, and to the function of digestion and of absorption.

A Suitable Diet.

1. Must be sufficient in quantity.
2. Must contain the proper proportion of proximate principles.
3. Must be digestible.
4. Must be adapted to climate, age, sex, stature and occupation, etc.

Quantity.

The quantity of nourishment required by a healthy adult doing an average amount of work, has been estimated (by analysing the waste discharged from the system) to be equivalent to about 3. lbs of cooked food and at least 2½ pints of fluid per day.

The following table indicates how the waste material is eliminated, and explains the method by which the correct weight of food necessary has been arrived at :—

Waste eliminated per day from the body of a healthy man doing moderate work.

	CARBON.	NITROGEN.	SALTS.	WATER.
By the Kidneys	150 grs.	270 grs.	400 grs.	48 ozs.
By the Lungs	4500 ,,			12 ,,
By the Skin				24 ,,
By the Intestines	167 ,,	16 ,,	139 ,,	4 ,,
	4817 grs.	286 grs.	539 grs.	88 ozs.

or in round numbers—

5000 grains of Carbon.
300 ,, ,, Nitrogen.
1¼ ozs. ,, Salts.
4½ pints ,, Water.

The amount of water eliminated is made up as follows—

Ingested with food which contains 50% of water	24 ozs.
,, as fluid	50 ,,
Chemically formed by the union of $H_2 + O$ (in the body)	14 ,,
	4½ pints or 88 ozs.

To estimate the amount of Nitrogen and Carbon contained in foods.

	N.	C.
1 oz. of Proteid is taken to contain	70 grs.	212
1 ,, of Fat ,, ,,		336
1 ,, of Carbohydrate ,,		190

The annexed analytical table will indicate how the amount of the specified articles of diet which would be required to balance the above waste may be calculated :—

	Grains Per lb.		
	Salts to Consolidate the Body	Nitrogen to form Flesh	Carbon to form Fat and give Heat
Average Meat	105	190	1900
Fat Pork	140	100	4000
Salt Pork	1750	290	1360
White Fish	70	200	875
Eggs	70	980	805
New Milk	35	45	600
Skim-Milk	56	45	550
Cheese	385	300	3300
Butter	175	21	6500
Bread	105	90	2000
Oatmeal	119	120	2700
Green Vegetables	49	14	420
Potatoes	70	22	770
Rice	35	70	2700
Sugar	35	—	3100

Twenty per cent. ought to be allowed for bone, and thirty per cent. for loss in cooking meat. The nutritive property of salt meat is one third less than of fresh meat.

The following table is also a very instructive one and may be perused with advantage.

NUTRITIVE VALUE OF FOOD.— (Letheby.)

Substances 100 parts	Water	Fibrine, Albumen, etc.	Starch, Sugar, etc.	Fat	Salts	Carboniferous	Nitrogenous	Total Nutriment
Human Milk	89	3·5	4·2	3·0	0·2	11·14	3·5	14·9
Cow's Milk	86	4·5	5·0	4·1	0·7	14·8	4·5	19·3
Skim-Milk	87	4·5	5·0	2·7	0·7	11·5	4·5	16·0
Butter Milk	87	4·5	5·0	0·5	0·7	6·0	4·5	10·5
Beef and Mutton	73	19·0	...	5·0	2·0	12·0	19·0	31·0
Veal	77	19·0	...	1·0	0·6	2·4	19·0	21·4
Poultry	74	21·0	...	3·0	1·2	7·2	21·0	28·2
Bacon	20	0·8	...	70·0	1·3	168·0	0·8	168·8
Cheese, Cheddar	36	29·0	...	30·0	4·5	72·0	29·0	101·0
Cheese, skimmed	44	45·0	...	6·0	5·0	14·4	45·0	69·4
Butter	15	...	...	83·0	2·0	199·0	...	199·0
Eggs	74	14·0	...	10·5	·5	25·0	14·0	39·0
White of Egg	78	20·0	...	...	1·6	...	20·0	20·0
Yolk of Egg	52	16·0	...	30·0	1·3	72·0	16·0	88·0
White Fish	78	18·0	...	3·0	1·2	2·4	19·0	21·4
Salmon	78	17·0	...	[illegible]	[illegible]·4	9·6	17·0	26·6
Eel	80	10·0	...	8·0	1·3	19·2	10·0	29·2
Wheat Flour	15	11·0	70·0	2·0	1·7	74·8	11·0	85·8
Barley-meal	15	10·0	70·0	2·0	2·0	75·8	10·0	85·8
Oatmeal	15	12·6	62·0	6·0	3·0	76·4	12·0	88·4
Rye-meal	15	9·0	66·0	2·0	1·8	70·8	9·0	79·8
Indian meal	14	9·06	65·0	8·0	1·7	84·2	9·0	93·2
Rice	14	7·0	76·0	0·3	0·3	76·7	7·0	83·7
Haricot	19	23·0	45·0	3·0	3·6	52·2	23·0	75·2
Peas	13	22·0	58·0	2·0	3·0	62·8	22·0	84.8
Beans	14	24·0	44·0	1·4	3·6	47·4	24·0	71·4
Lentils	14	29·0	44·0	1·5	2·3	47·6	29·0	76·6
Wheat bread	44	9·0	49·0	1·0	2·3	51·4	9·0	60·4
Rye bread	48	5·0	46·0	1·0	1·4	48·4	5·3	53·7
Potatoes	74	2·0	23·0	0·2	0·7	23·5	2·0	25·5
Green Vegetables	86	2·0	4·0	0·5	0·7	5·0	2·0	7.0
Arrowroot	18	...	82·0	...	...	82·0	...	280

In this table the carboniferous matter is calculated as starch; 10 of fat being equal to 24 of starch.

It has been repeatedly proved that a suitably selected diet to contain 5000 grs. Carbon, 300 grs. Nitrogen, and 1¼ ozs. of Salts, would weigh uncooked 24 ozs., and cooked (on account of the water absorbed by farinaceous substances) 48 ozs. or 3 lbs.

The following is the diet scale usually adopted by scientists as being a moderate one—

Nitrogenous food	4½ ozs	=300 grains of N.
Carbohydrates "	15 "	=5000 " of C.
Fats or Hydrocarbons	3 "	
Salts	1¼ "	=547 "
	23¾ ozs.	

To balance the loss of 88 ozs of water each day from the system, in addition to the 23¾ ozs. contained in the cooked food, 64¼ ozs, or a little over 3 pints, requires to be supplemented as drink.

Hereunder is a list of some of the principal animal and vegetable sources of flesh, fat, and heat-giving elements.

NITROGENOUS FLESH-FORMERS.

Animal		*Vegetable*	
Meat	Game	Flour	Macaroni
Fish	Eggs	Oatmeal	Peas
Poultry	Cheese	Barley	Lentils

CARBONACEOUS HEAT-GIVERS.

Animal.		*Vegetable.*	
Butter	Dripping	Sugar	Oils
Suet	Fat	Fat	Starch
Lard			

The Necessity for a Mixed Diet.

Inasmuch as 300 grains of nitrogen and 5000 grains of carbon are required each day to sustain the body and maintain the functions of a healthy adult, the correct proportion of nitrogen to carbon in a well arranged diet should be approximately 1 to 17.

Milk is the only food suitable for human beings in which the nitrogen and carbon is present in this ratio, and yet it is a typical food for infants only.

As may be seen by perusing the tables given, animal foods predominate too excessively in nitrogen, and vegetable foods in carbon, for either of them alone to afford a suitable diet, and hence a mixed diet is indicated by nature.

Animal proteids and fats are precisely similar in chemical composition to the flesh and fat of the human body, and therefore are easier to digest and satisfy the wants of the system more readily than vegetable proteids or fats.

In this climate, the possibility of the majority of people living in the enjoyment of health and in the full exercise of their energy on a purely vegetable diet is out of the question, and is negatived by general experience. "Vegetarians," in addition to the richest and most nourishing vegetable foods (pulses and cereals) with scarcely an exception, ingest also *milk*, *eggs* and *butter*, which are the most valuable and typical animal products known.

Roots and Tubers.

Potatoes, carrots, onions, turnips and artichokes, contain such a large proportion of water (about 85%) and indigestible material—in the form of cellulose and woody fibres—that they could never alone constitute a suitable diet for human beings. For instance—quite apart from considering the correct proportion of proximate principles (1 to 17) and the amount required to obtain from such a diet the 24 ozs. of dry solid nourishment necessary per day, a man would require to ingest at least 10 lbs. of such cooked food, and as the stomach of a human being is not adapted to execute such a feat, the experiment would prove disastrous ere many such attempts were repeated.

The following table indicates approximately the single quantities of different articles one would have to ingest to obtain the required amount of Nitrogen and Carbon for a day's sustenance, and further proves the inadequacy of any but a mixed diet to fulfil the requirements of nature.

TO OBTAIN FLESH-FORMERS AND FAT-FORMERS

Good Meat	1½	lbs.	=	300 grs.	of N.	2¾	lbs.	=	5000 grs.	of C
Fat Pork	3	”	=	”	”	1⅕	”	=	”	”
Salt Pork	1	”	=	”	”	3¾	”	=	”	”
Salt Beef	1	”		”	”	4	”	=	”	”
Tripe	2	”	=	”	”	1⅓	”	=	”	”
Poultry	2⅓	”	=	”	”	3½	”	=	”	”
White Fish	1½	”	=	”	”	5½	”	=	”	”
Eggs	20	”	=	”	”	20	”	=	”	”
Milk New	7	”	=	”	”	8	”	=	”	”
Skim-Milk	7	”	=	”	”	11	”	=	”	”
Cheese (New Milk)	1	”	=	”	”	1⅖	”	=	”	”
Butter	0	”	=	”	”	¾	”	=	”	”
Bread	3⅓	”	=	”	”	2⅕	”	=	”	”
Flour	2¾	”	=	”	”	1¾	”	=	”	”
Oatmeal	2⅛	”	=	”	”	1¾	”	=	”	”
Indian Meal	2¾	”	=	”	”	1⅔	”	=	”	”
Peas	1¼	”	=	”	”	1⅖	”	=	”	”
Green Vegetables	20	”	=	”	”	12	”	=	”	”
Carrots	20	”	=	”	”	10	”	=	”	”
Potatoes	14	”	=	”	”	6	”	=	”	”
Rice	4⅓	”	=	”	”	1¾	”	=	”	”
Sugar	0	”	=	”	”	1⅖	”	=	”	”
Cocoa	1	”	=	”	”	⅝	”	=	”	”

Thus, for instance, to obtain the necessary amount of carbon (5000 grains) one would have to ingest 2¾ lbs. of meat per day; and, if one did so, far too much nitrogen (420 grs.) would have to be consumed at the same time: Whereas by combining meat, bread, and vegetables a cheaper and more suitable diet is easily obtainable. Or taking cheese:—Instead of requiring 1⅖ lbs. of cheese—4 ozs. of cheese and 1½ lbs. of bread 8 ozs. of meat and a little butter and sugar would supply the requirements of the system with 300 grs. of nitrogen and 5000 of carbon, and answer much better than a diet of cheese alone.

From the foregoing considerations it is therefore evident that substances rich in one element must be partaken of with those rich in others which they do not contain in sufficient quantity, and, indeed, the prompting of nature invariably indicates this to be the correct plan; and all good standard diets are arranged on such principles.

¶ GREEN VEGETABLES AND LUSCIOUS FRUITS contain on the average nearly 90% of water, and though they are very poor in nitrogen and carbon yet they are particularly valuable

adjuncts to diet because they are so rich in vegetable salt, juices and acids which purify the blood.

Cereals and Pulses.

It should be particularly noted that the pulses, peas, beans and lentils, and to a lesser degree, the grains of the cereals—wheat, barley, rye and corn—are particularly rich in nitrogenous flesh-forming as well as in carbonaceous fat and heat-giving elements as compared with all other vegetable products, and even with the richest of animal products.

The following tables will give a better idea of the futility of attempting to live upon a diet exclusively composed of either vegetables, fruits, or nuts, and as the figures given indicate ounces per hundred, if one but calculates, there will be no difficulty in satisfying oneself that to obtain the necessary

	4½	ounces	of	Proteid
	15	„	„	Carbohydrate
	3	„	„	Fat
and	1½	„	„	Salt Material

required for a day's diet, enormous amounts of such foods would have to be eaten.

COMPOSITION OF VEGETABLES.

	WATER.	PROTEID.	FAT.	CARBO-HYDRATES.	SALT.
Cabbage (cooked)	99·4	0·6	0·1	0·4	0·13
Cauliflower	90·7	2·2	0·4	4·7	0·8
Sea Kale (cooked)	97·95	0·4	0·07	0·3	0·2
Spinach	90·6	2·5	0·5	3·8	1·7
Marrow (cooked)	99·17	0·09	0·04	0·2	0·05
Sprouts	93·7	1·5	0·1	3·4	1·3
Tomatoes	91·9	1·3	0·2	5·0	0·7
" (cooked)	94·07	1·0	0·2	0·1	0·76
Greens	82·9	3·8	0·9	8·9	3·5
Lettuce	94·1	1·4	0·4	2·6	1·0
Leeks	91·8	1·2	0·5	5·8	0·7
Celery	93·4	1·4	0·1	3·3	0·9
" (cooked)	97·0	0·3	0·06	0·8	0·5
Rhubarb	94·6	0·7	0·7	2·3	0·6
Watercress	93·1	0·7	0·5	3·7	1·3
Cucumber	95·9	0·8	0·1	2·1	0·4
Asparagus	91·7	2·2	0·2	2·9	0·9
Endives	94·0	2·0		3·0	0·8
Savoys	87·0	3·3	0·7	6·0	1·6
Red Cabbage	90·0	1·8	0·19	5·8	0·7

Thus for instance, to obtain 300 grains of N. from cabbage, one would have to eat in grains

$$\frac{300}{\cdot 6} \times 100 = 50000 \text{ grains}$$

or about 7 lbs. weight each day.

COMPOSITION OF FRUITS.

	WATER.	PROTEIDS.	CARBO-HYDRATES.	SALTS.
Apples	82·5	0·4	12·5	0·4
„ (dried)	36·2	1·4	57·6	1·8
Pears	83·9	0·4	11·5	0·4
Apricots	85·0	1·1	13·4	0·5
Peaches	88·8	0·5	5·8	0·6
Greengages	80·8	0·4	14·4	0·3
Plums	78·4	1·0	20·1	0·5
Cherries	84·0	0·8	10·0	0·6
Gooseberries	86·0	0·4	8·9	0·5
Currants	85·2	0·4	7·9	0·5
Strawberries	89·1	1·0	6·3	0·7
Blackberries	88·9	0·9	7·5	0·6
Raspberries	85·8	1·0	12·6	0·6
Grapes	79·0	1·0	16·0	0·5
Melons	89·8	0·7	8·6	0·6
Bananas	74·0	1·5	22·9	0·9
Oranges	86·7	0·9	9·7	0·6
Lemons	89·3	1·0	8·3	0·5
Pine Apple	89·3	0·4	9·7	0·3
Dates (dried)	20·8	4·4	65·7	1·5
Figs „	20·0	5·5	65·0	2·3
Prunes „	26·4	2·4	68·9	1·5
Currants „	27·9	1·2	65·7	2·2
Raisins	14·0	2·5	74·7	4·1

COMPOSITION OF NUTS.

	WATER.	PROTEIDS.	FAT.	CARBO-HYDRATES.	SALTS.
Walnuts	44·5	12·0	31·0	9·4	1·7
Filberts	48·0	8·0	28·5	11·5	1·5
Almonds	6·0	24·0	54·0	10·0	3
Cocoanuts	46·6	5·2	35·9	8·4	1·3

Accessory Foods.

Several articles of diet are not essential to health but being useful are regarded as accessory foods :—Mustard, Pepper, Spices and other condiments are the best examples of this class. As they often stimulate the appetite and aid digestion they are for these reasons of considerable nutritive value. Children, however, should not require to have their appetites thus stimulated, and they are not benefited by hot condiments, and are better if trained to dispense with them entirely.

Beverages.

Tea, Coffee and Cocoa are, for most adults, harmless accessory beverages, if taken properly and in moderation, for they truly stimulate the functions of the body. *Alcohol is regarded by some as an accessory beverage ; it ought, however, to be classed as a medicine.*

The Influence of Improper Diets.

The effects of an unsuitable diet on the human body are characterised by marked evidences of defective nutrition of which the following are some of the chief indications.

Deficient Food tends to general wasting and bloodlessness, and predisposes to all diseases.

Infants underfed cease to gain weight, are restless, feverish, ravenous, and pallid, and pass unhealthy looking and irregular stools.

Excess of Food sets up fermentation in the stomach which causes offensive eructations, and a feeling of load, pain, distention, and discomfort, and often gives rise to feverishness, sickness, diarrhœa, attacks of biliousness, and food poisoning.

Deficient Nitrogenous or flesh-forming Food is indicated by pallor, want of muscular tone and development, and an absence of the inclination, energy, or capacity to work.

Deficient Carbonaceous or Fat-forming and Heat-giving Food leads to wasting, loss of fat, and coldness of the body.

Deficient Salts in Food predisposes to and causes rickets, scurvy, and many other conditions which are due to an impoverished blood supply.

An Excess of Nitrogenous Food is credited with being often one of the chief causes of gout, and of many other ailments which impure surcharged blood may cause.

An Excess of Carbonaceous Food causes obesity, listlessness, inactivity, flatulence, acidity and other dyspeptic conditions.

Food and Digestion.

As the nutritive value of diet depends upon its digestibility and absorbability:—Food should not only contain the necessary amount of Nitrogen, Carbon, and Salts, but should also contain them in a digestible and absorbable form. Apart from the relative digestibility of different substances, cooking affects most articles of diet favourably in this respect, by softening and gelatinising the fibre of fresh meat; and by bursting the coating and softening the starch granules of cereal and vegetable food. In connection, however, with this subject within certain limits, it must not be overlooked, that both as to the quality and quantity of food required by an individual, much depends upon the personal factor—For some people require much food, whereas, others who are equally as robust, perhaps more so, can do on very little, and substances of very easy digestion for most people, may prove very indigestible to others. I desire particularly to impress these points to prevent any possible misconception, upon the subject of the digestibility of food. As the following tables represent average results

only, they therefore, at times, cannot be depended upon to prove accurate as applied to certain individual cases.

I. Relative Digestibility of Vegetable Substances.

	Hours		Minutes
Rice	B.	1	0
Apples (sweet and mellow)	R.	1	30
Sago	B.	1	45
Tapioca	B.	2	0
Apples (sour and mellow)	R.	2	0
Barley	B.	2	0
Cabbage (with vinegar)	R.	2	0
Beans	B.	2	30
Sponge Cake	Ba.	2	30
Parsnips	B.	2	30
Potatoes	Ro.	2	30
Potatoes	Ba.	2	33
Apple Dumpling	B.	3	0
Indian Corn Cake	Ba.	3	0
Indian Corn Bread	Ba.	3	15
Carrots	B.	3	15
Wheat Bread	Ba.	3	30
Potatoes	B.	3	30
Turnips	B.	3	30
Beets	B.	3	45
Cabbage	B.	4	0

II. Relative Digestibility of Animal Substances.

		Hours	Minutes
Tripe (soused)	B.	1	0
Eggs (whipped)	R.	1	30
Salmon Trout	B.	1	30
Venison Steak	Br.	1	30
Brains	B.	1	45
Ox Liver	Br.	2	0
Cod fish (cured dry)	B.	2	0
Eggs	Ro.	2	15
Turkey	B.	2	25
Gelatine	B.	2	30
Goose	Ro.	2	30
Pig (suckling)	Ro.	2	30
Lamb	Br.	2	30
Chicken	Fr.	2	45
Beef	B.	2	45
Beef	Ro.	3	0
Mutton	B.	3	0
Mutton	Ro.	3	15
Oysters	S.	3	30
Cheese	R.	3	30
Eggs	H.B.	3	30
Eggs	F.	3	30
Beef	F.	4	0
Fowls	B.	4	0
Fowls	Ro.	4	0
Ducks	Ro.	4	15
Cartilage	B.	4	15
Pork	Ro.	5	15
Tendon	B.	5	30

Br.=broiled B.=boiled Ba=baked H.B.=hard boiled F.=fried Fr.=fricassed R.=raw Ro.=roast S=stewed.

CHAPTER V.

Section I.—The Nutritive Value of Different Diets.

In now summarising and estimating the relative merits of different classes of food, I am guided by the researches of the foremost scientists of the day, and as I am perfectly unbiassed in the matter, and do not hold any extreme views whatsoever respecting diet, I hope and believe the conclusions I have arrived at may prove trustworthy.

Generally speaking the Carbohydrates and Fats of food are more completely absorbed from the intestines than the Proteids; *and proteids of animal origin are much more readily absorbed than those of vegetable.*

It is, however, useful and essential that thorough absorption of all proximate principles should not always occur, for were such the

case, the residue necessary to excite the bowel to activity would often be absent.

MEAT.

There is not any doubt of the fact that for building up and repairing, and for sustaining the heat of the body the proteid constituents of food are the most valuable elements, the complete proof of which being that life can be maintained and health sustained on a diet of lean meat and water; (Salisbury diet for Obesity). Though, of course, such a regime is only justifiable under exceptional circumstances. Meat to be most nutritious should not be eaten until some days elapse after the animals have been killed, otherwise it is tough and indigestible.

Recent research has demonstrated that finely scraped raw meat is all but completely digested and absorbed, and that, but one twentieth part only of its bulk ingested is discharged through the intestines. Red meat, such as rump steak, is richer in proteid flesh-forming principles, and iron, and blood-making properties, than any other class of food, and from an economical

point of view is consequently the cheapest animal food to buy.

Animal fat is all but completely absorbed; but, as it does not undergo digestion until it has reached the intestines, its presence in excess interferes with the proteid digestion of the meat which contains it (in the stomach); hence, all fatty animal foods are less digestible than lean kinds.

The internal organs of all animals are difficult of digestion—except, perhaps, *Sweet-bread and Tripe*—and as they contain a considerable amount of what is termed nucleo-proteid material, which is a source of uric acid, they are bad for gouty subjects.

Gelatin, if it does not build up muscle, spares the wear and tear of it, and, therefore, jellies are of much greater nutritive value than some suppose. Clear soups and meat extracts are appetising in some instances, and also stimulating, but they are otherwise of little, if any food value, and *home-made* preparations are better than those bought, as a rule, for they contain less salty mineral and extractive matter and are superior in flavour and digestibility.

FISH.

Lean fish is more digestible than fat fish, and, as fish is less stimulating than meat, it is a useful substitute for meat in certain conditions which will be hereafter indicated.

Oysters contain :—

86·9	per cent.	of	Water
6·2	"	"	Proteid
3·7	"	"	Carbohydrates
·2	"	"	Salt

and are therefore of small nutritive value, though they are easily digested when eaten raw. I might here also point out that it is a fallacy to suppose that fish contains any particular element specially adapted to antagonise brain waste.

MILK.

Though the composition of milk has, and will be, further alluded to, here I might, however, mention that the proteids of milk do not develop Uric Acid; and, hence, milk is specially adapted for those who are gouty and suffer from allied conditions. Children absorb milk better than adults (though a large part

of it passes through them also), and hence for them alone it is a suitable diet for ordinary use. The principal mineral matter in milk consists of lime—and about eight grains of *Citrate and Phosphate* of lime are contained in a pint of it. As milk however contains too little *Iron* (about $\frac{1}{30}$ th of a grain to the pint) thus it is not a suitable *exclusive* diet for children beyond the tenth month of life, and children are apt to become debilitated, anæmic, and badly nourished if kept entirely on it.

EGGS.

Eggs are very nourishing, and the yolk of an egg is particularly so as the following analysis indicates :—

COMPOSITION PER HUNDRED PARTS.

12	SHELL.	WATER.	PROTEID.	FAT.	ASH.
58	White.	85·7	12·6	0·25	0·59
30	Yolk.	50·9	16·2	31·75	1·09

As the yolk of an egg contains much *Phosphorus*, *Iron*, *Proteid*, and *Fat*, eggs are a most valuable form of food for children and adults alike. The nutritive value of one egg is about equivalent to half a tumblerful of milk. Eggs

are all but completely absorbed from the intestines into the system, 5 per cent. only passing away by the bowel.

Vegetable Foods.

All vegetables we have seen by analysis are, with the exception of Cereals, Pulses and Nuts, of slight nutritive value and owing to their containing so much water and woody fibre afford too bulky a diet to attempt exclusively to live on. Even, the Cereals and Pulses take up so much water on cooking that they, too, when ingested largely cause indigestion, flatulency and incapacity for work; and further, as vegetable proteids are neither as easily digested or absorbed as those of animal origin, large quantities unduly tax the digestive system. As constituents of a mixed diet, however, Vegetables and Cereals are all but essential for the maintenance of good health, for their very bulkiness ensures the regular action of the bowel. In illness, too, if taken in a suitable form, vegetable food is most useful, for it is unstimulating, puts less stress on the kidneys, and lessens the accumulation of uric acid in the system.

Roots and Tubers are, as can be seen by the tables given, but of little nutritive value, in a formative sense, because they are so poor in Nitrogen.

Potatoes are however the best representative of this class of food, and as potatoes contain, in the most marked degree, the characteristic salts present in other species of the same order of plants which are so purifying to the blood, they are most valuable articles of diet and are preventive of Scurvy and other allied conditions.

Green Vegetables are valuable articles of diet on account of the potash salts contained in them; and because they ensure the regular action of the bowels by reason of the irritation to contraction set up by the indigestible cellulose or woody fibre of which they are so largely composed. Vegetables too are also beneficial for persons afflicted with Gravel or Uric Acid, as the salts they contain dissolve it.

FRUITS.

An examination of the analytical tables given will indicate that practically all fresh fruits are of little nutritive value. Their value as part of a mixed diet is alone due to the juices,

salts, and indigestible fibre of which they are composed. When dried, however, they are of much greater value, for they then contain a larger percentage of sugar, which is a most useful and economical article of diet for supplying the body with heat and energy and sparing the waste of the proteid and fatty structures of the human organism. Perhaps of all fruits, in the natural and fresh state, grapes are the most nutritious, and hence grape cures are practised on the Continent in conditions of obesity, plethora, bronchitis, constipation, and kidney disease. The treatment consists in consuming as much as eight pounds of grapes daily, at and between meals, in addition to other light articles of diet, and taking plenty of exercise.

Nuts.

.Nuts as may be seen are rich in fat and contain a large proportion of proteid matter. They are, however, very poor in starch, and are hard to digest as their structure is so woody and tenacious.

The Fungi Lichens, and Algæ.

Mushrooms, truffles and mosses, are of

negligible nutritive value, and as they are mostly (with the exception of moss) very indigestible, are often a source of dyspeptic trouble.

In concluding the subject of *Food in Health* I would draw attention to what I consider is the logical and common-sense view of the whole subject of diet. That diet, of whatever it may be constituted, is the one best adapted to the individual who ingests it, which will ensure the most perfect functional activity of his mind and body. And the best practical proof by which to judge, is that the energy and weight of the body is in accordance with that which should characterise its condition in perfect health. Therefore, to attempt to lay down one counsel of perfection for all people would be an absurdity. The truth of this statement must be obvious to all who will consider that season, climate, sex, stature, occupation, and clothing, condition of health and idiosyncrasy are all important factors in determining individual dietetic requirements; and that individual peculiarity or idiosyncrasy also causes food which is excellent and healthful for some, to be poisonous

to others. Nevertheless, in precisely the same way as races of people are characterised at different age periods by possessing bodies of average size and weight, and have to accomplish an average daily amount of work to earn their living, it is quite justifiable to believe that for general purposes average diet tables are the only fundamental means of guidance for arriving at the most correct conclusions applicable to ninety-nine per cent. of humanity living under similar conditions of environment, and engaged in the same class of labour. Thus, for instance, the puny naked native of India who indolently swelters under a tropical sun, requires little food to support his animal heat, and can practically live on a diet —of rice, herbs and water—upon which a brawny north countryman of ours would succumb very quickly.

Lacto-vegetarian Diet.

There is, of course, no gainsaying that a lacto-vegetarian diet, which is composed of milk —and its products, cream, cheese, and butter— and cereals, pulses, roots, tubers, fungi, and fruit

is one upon which life can be sustained and good health maintained. The expense of a well-regulated and varied diet of that description would, however, be beyond the means of any but the wealthier classes; though for a not over-palatable, yet sufficient supply of cereals, pulses, buttermilk, and eggs, and an absence of choice vegetables and fruits, the cost would not amount to more than about half of what a fish, flesh and fowl régime would be. As to the question of the advantages of the general use of such a diet I certainly have very grave doubts, and though I willingly concede that there are many old and elderly people who are and would be benefited by not ingesting fish, flesh, or fowl, I believe many exceptions would be found to those who would thrive on such a diet. Inasmuch, however, as elderly people require less food than vigorous, hard-working adults (for their physical development has ceased and the labour they can engage in is less arduous) it is possible very many more than do, would enjoy hale old age by adopting such a régime.

The alleged fact that Cornaro, an Italian, lived to be a hundred years old, and enjoyed perfect

health, both physical and mental, on a daily diet which only weighed twelve ounces (composed of bread, broths, eggs, veal, mutton, partridges, chicken, and fish, and a little wine), supports my contention that the reason why many elderly people can live upon a lacto-vegetarian diet is because the bulk of the vegetable food they ingest to compensate for wear and tear is far less than is required at a time of perfect physical manhood, for it is not alone the difficulty of digesting vegetable proteids, but also the bulkiness of vegetable food which makes it unsuitable. Of course, also, if milk, butter and eggs form the principal and major part of the food, there is no question about the possibility of their enjoying good health on such a mixed diet, for three pints of milk with a little bread and butter and a couple of eggs would prove a sufficient daily régime for most old men.

The benefit of a lacto-vegetarian diet has been fully established in many cases of disease due to an excess of uric acid in the blood, intestinal fermentation, and nerve derangement, and such is not to be wondered at, for we know that the mineral salts contained in vegetables

are antiscorbutic and purifying, that the indigestible woody fibres they contain excite the intestines to activity, and, lastly, that their proteid constituents are less stimulating than those of animal origin; and as milk has a tendency to arrest intestinal putrefaction it is but natural that such a diet is very suitable for many cases. Children, too, are often well nourished on a lacto-vegetarian diet which contains plenty of fat to keep them warm; and though they require sufficient proteid material to build them up, as they digest milk well, they can obtain it from that source. As to the question of the general suitability of such a régime for healthy, hard-working, vigorous adults, who cannot digest milk as well as children, and who cannot afford to be made unwieldy and bloated with vegetables, and require their food to be quickly digested, absorbed and assimilated, and converted into energy, the answer must be in the negative. The principles then which I would strive to inculcate are the following:—

1. For nearly everyone a mixed diet of animal and vegetable origin is essential.

2. Vigorous adults in particular, require a meat and vegetable diet.
3. Old people can maintain their health and strength on little meat, if milk, or milk products and eggs, be substituted for it.
4. Children require a mixed diet preponderating in starch and fat.
5. Infants up to nearly the period of weaning require nothing but mother's milk.

And to these postulates I would also add that:

1. Proteids build up and energise the body.
2. Carbohydrates and vegetable starches store up heat and fat.
3. Fats and oils give immediate heat and energy.
4. Animal and vegetable salts consolidate the tissues and purify the blood.
5. Water is the great medium by which every tissue is formed and maintained, and all the above reparative and energising processes are accomplished, for the blood and all the circulating fluids of the body are mostly composed of water.

Section II.—Do People Eat Too Much?

Abernethy said,

"I tell you honestly what I think is the cause of the complicated maladies of the human race; it is their gourmandising and stuffing, and stimulating their digestive organs to an excess, thereby producing nervous disorders and irritation. The state of their mind is another grand cause; the fidgeting and discontenting themselves about that which cannot be helped; passions of all kinds—malignant passion and worldly cares—pressing upon the mind disturb the cerebral action and do a great deal of harm."

And truth to tell, Abernethy's conclusions as to the causes of human suffering in his day are to an even greater extent incontrovertible, as applied to some of the existing conditions which obtain in many modern communities. And for this reason—as civilisation has advanced—life has become less simple in every particular. Each year has added, and continues to add, new articles of diet—but too many of which are practically "mummified" and preserved in poisonous tins, and unwholesome—to an already long list, and, consequently, in this

respect, the tax upon the digestive organs has become greater. The severer stress of modern life, too, and the grimmer "struggle for existence" in every pursuit, causes infinitely greater mental perturbation—which is, perhaps, a more potent factor in disturbing the digestive functions than all others combined—and as working hours are also more crowded there is less time for eating; and many people are compelled to "bolt" their food, and take their meals at irregular hours, and hence suffer from the miseries of dyspepsia, and from other ailments which it originates.

In the matter, however, of "gourmandising and stuffing," I certainly believe a change has come o'er the scene, and that orgies similar to which our ancestors were wont to hold, are all but unknown in the present day.

I am confident also that even the classes who "neither spin nor toil"—and they are numerically insignificant as compared with our teeming millions of workers—are now far more careful and temperate in their habits than they ever have been.

As for the general population of this country and the working classes in particular, I am quite

sure they *Do not eat too much* (though they may eat unwisely).

As a matter of fact, judged by modern standards, in my opinion, the industrial and lower commercial and professional classes have not the means to afford either themselves or their families an excessive amount of food: and a visit to any General or Special hospital will prove what I say to be true.

For nearly all the cases treated at children's hospitals result from malnutrition due either to improper or insufficient food, or to causes to which such régimes have predisposed. In all but every instance 'tis ever the same story.

"WANT OF FOOD AND AIR."

At General hospitals, too, where adults are also attended, the same causes account for the majority of the ailments treated; and such being the case, it is no exaggeration to affirm that both in children and adults—though more markedly in the former—nearly all the known preventible diseases (and two thirds of the mortality registered in the United Kingdom is due to diseases which better hygiene would arrest) are attributable in a great measure to

the lack of stamina which deficient food and impure air engender, by lessening the power of the living cells of the body to resist the inroads of disease.

The Cost of Food.

It would be foreign to the scope of this work to discuss at any length the economic causes which might account for the opinions I have expressed. In support of my contentions, however, I would submit a concrete instance—which is very far from being either an extreme or an unusual one.

The case in point is that of a working man, possessed of a wife and five children, who is in receipt of thirty shillings a week from his employer.

Now, according to the most recent and authoritative economists this man should set aside half his wages for rent, firing and clothes, &c.

So we shall have to consider if the fifteen shillings balance is enough to provide a sufficient, digestible and varied food supply for himself and family.

Counting the five children as equivalent to two adults—in all four daily rations will have to be provided.

To assist in the matter I here give four standard diet tables and the relative cost of same.

	Ounces	
Beef . . .	10	3½d.
Ham . . .	6	3d.
Two eggs . . .	3	2d.
Butter . . .	2	2d.
Milk, 1 pint . .	16	2d.
Potatoes . .	12	¾d.
Flour . . .	9	¾d.
Sugar . . .	1	¼d.
	59	1/2¼

	Ounces	
Beef . . .	13	6d.
Butter . . .	3	3d.
Potatoes . .	6	½d.
Bread . . .	22	2½d.
	44	1/0.

	Ounces	
Beef (Neck) . .	10	2½d.
Butter . . .	1	1d.
Milk . . .	16	2d.
Potatoes . .	16	1d.
Oatmeal . .	4	1d.
Bread . . .	16	2d.
Sugar . . .	3	½d.
	66	10d.

	Ounces	
Pork (salt) . .	4	1½d.
Butter . . .	2	2d.
Beans . . .	16	2½d.
Bread . . .	8	1d.
	30	7d.

Even allowing that the foregoing régimes are computed on the assumption that they are sufficient for men engaged in moderate muscular work, it will be at once evident that to obtain a proper supply of food, a family composed of a man, wife and five children, could not live properly on less than about £1 a week, or 4/- per head. Indeed it costs the most economical of our poor law authorities quite as much, if not more than this, though they contract and purchase food at the most advantageous terms. I know of course critics will say "but on peas, beans, potatoes, lentils, and skim-milk and cheese, a cheaper régime can be constructed;" and I admit such to be the case, and to be feasible for temporary purposes. But for people habitually to live and enjoy good health upon a diet mainly composed of vegetables and unconsidered animal trifles is quite another matter, and one to which I have already pretty fully referred.

Again, it will be found that even a sufficiency of beans, peas, or lentils alone, at the present market price would cost 4d. per day, to which surely would have to

be added, the cost of some fat, salt, and accessory articles.

To reduce the argument to its simplest form for ordinary fare the following estimate indicates 9d. a day to be a fair one as to cost.

Ounces		
32	of Carbohydrate (say bread)	2½d.
8	of Proteid food (meat)	3d.
4½	of Animal fat (butter, suet &c)	1½d.
3½	of Accessories (Tea, sugar, milk pepper, salt &c)	2d.
48oz.		9d.

From the foregoing example it will be seen that the Carbohydrates we consume, as compared with the fats and proteids, are relatively considerably cheaper; and it is for this reason that a mostly vegetable diet is more economical than an animal one. A reference to a previous chapter, which accounts for the amount of either an exclusive vegetable or animal diet, necessary to support the body, will serve further to make this matter clear; and will establish that the cheapest animal food (skim-milk) as compared with the cheapest vegetable food (peas) is four times as costly in respect of its nitrogenous tissue-building composition.

I need scarcely say that if our working classes adhered to the above scales, more open spaces than overcrowded rooms would be occupied, therefore the consequence is, that as they must have some food and must have some habitation, they are compelled to be satisfied with less of both than they require; and hence "want of food" and "want of air" are the source of their physical and psychical ill health—certainly not "gourmandising and stuffing."

There are many social workers who believe "Drink" to be the fetish and the *Fons et origo mali*—and though I am convinced, as a factor, it is an all imporant one, yet, I believe, for experience has taught me, that it is principally lack of food and comfort which impels and enslaves the poor to alcoholism.

For alcohol is a *Poison* which lessens the functional activity of the organism, and engenders a feeling of satiation as regards food, and of longing as regards drink.

As to the majority of young persons such as dressmakers, stitchers, waitresses engaged in businesses in London, being insufficiently fed, there is but little doubt, for more than half these young women suffer from Anæmia

and conditions to which malnutrition gives rise. With them, tea (often stewed) takes the place of alcohol, to lessen their bodily waste and quiet their hunger.

Our young men are not much better off, for many, engaged in commercial and other pursuits, fast upon a hastily snatched breakfast, and an insufficient mid-day meal until evening, when they are either too fatigued to eat, or else so famished that they overload their stomachs with food. For them, a smoke, by the way, takes the place of alcohol or tea, to stimulate their senses and narcotise their hunger.

As for those people who are compelled to "keep up an appearance" upon a limited income —how they live, none but themselves can e'er tell.

The best proof that sufficient food is being ingested, digested, and assimilated is that one

1. Feels happy,
2. Sleeps well,
3. Eats with an appetite,
4. Is capable of doing an average amount of work,

5. And is, and keeps, at an average weight (preferably a little above it).

Of course, in arranging food estimates, sight must not be lost of the fact that it is principally to keep up the heat of the body to sustain the energies, that the bulk of our food is required: and, hence, people who are idle, and do not take exercise to oxidise and consume their tissues rapidly; and who in addition are well clad and housed, and in other respects protected from the cooling effects of the atmosphere, are capable of living, upon perhaps one half the amount of food required by others less fortunately placed.

AVERAGE WEIGHTS AND HEIGHTS

Males			Females		
Age last birthday	Height ft. in.	Weight st. lb.	Age last birthday	Height ft. in.	Weight st. lb.
1	2 5½	1 4½	1	2 3½	1 4
2	2 8½	2 4½	2	2 7	1 11¼
3	2 11	2 6	3	2 10	2 3½
4	3 1	2 9	4	3 0	2 8
5	3 4	2 12	5	3 3	2 11
6	3 7	3 2½	6	3 6	2 13¾
7	3 10	3 7¾	7	3 8	3 5½
8	3 11	3 13	8	3 10½	3 10
9	4 1¾	4 4½	9	4 0¾	3 13½
10	4 3¾	4 11½	10	4 3	4 6
11	4 5½	5 2	11	4 5	4 12
12	4 7	5 6¾	12	4 7½	5 6½
13	4 9	5 12½	13	4 9¾	6 3
14	4 11¼	6 8	14	4 11¾	6 12¾
15	5 2¼	7 4¾	15	5 1	7 8¼
16	5 4¼	8 7	16	5 1¾	8 1
17	5 6¼	9 5	17	5 2½	8 3½
18	5 7	9 11½	18	5 2½	8 9
19	5 7¼	9 13½	19	5 2¾	8 12
20	5 7½	10 3¼	20	5 3	8 11½
21	5 7½	10 5	21	5 3	8 10
22	5 7½	10 7	22	5 3	8 11½
23	5 7½	10 7½	23	5 3	8 12
24	5 7¾	10 8	24	5 2¾	8 9
25-30	5 7¾	10 12¼	25-30	5 2	8 8
31-35	5 8	11 6	31-35	5 1	8 9

AVERAGE WEIGHT OF A MALE INFANT

	Lbs.	Oz.
At Birth	6.	8
1st month	7.	4
3rd „	9.	6
6th „	12.	4
9th „	15.	8
1 Year	18.	8

CHAPTER VI.

The Diet of Infancy, Childhood, and Adult Life.

THE influence of age, sex, stature, occupation, and climate, on diet may now be considered with advantage.

INFANCY.

The subject of infant food has agitated the minds of the world since the dawn of history, and yet, perhaps, more ignorance generally prevails respecting it, than of any other matter connected with the wellbeing of humanity. Scarcely two people are in agreement except upon the one principle, which is, that the sustenance intended by nature on which to rear babies is mother's milk, and even about this, few people hold precisely similar views. There are some over-zealous mothers, who persist in their efforts to outdo "Mother Nature,"

and foolishly imagine they can improve upon her methods to expedite human growth and development by supplementing her gift with cow's, asses', goat's, condensed or desiccated milk, starches, sugars, fats, sheep's brains, drugs, and hosts of other miscellaneous products too numerous to catalogue; and long before the new-born infant possesses the vitality to survive such treatment, it is fed on every variety of solid food. Other mothers wanting in zeal, gladly persuade themselves of their incapacity to discharge the *duty* designed for them in the roll of creation, and are willingly convinced that cow's milk can be humanised. The sooner, indeed, it becomes generally known, that to humanise the milk of a cow is as impossible as to humanise the cow herself, the more frequent will it be for mothers to feed their babies with their own milk, and the happier will be the prospect for this, and future generations. For of every 1000 children born in England and Wales each year, 150 die before they are twelve months old, and worse still, most of these innocents die of diseases caused by improper feeding. Indeed, the annual death toll from

diarrhœa, *convulsions*, and other *infantile* ailments has not much improved in the last 50 years, and is not likely to improve in the next, unless greater attention and care is given to the solution of the apparently simple problem of "How shall I feed baby?"

"The child is father of the man," and, therefore, it should not be forgotten that the whole after-life and history of an infant is influenced by all conditions which affect it, even from the very period of its conception.

When a mother is unable or unwilling to nurse her offspring, it necessarily follows that a foster-mother or "wet nurse" should be secured; and theoretically there can be no exception taken to the soundness of this conclusion. Practically, however, it must be admitted, the possibility of adopting this course is not often feasible, as the cost is great, the difficulty to surmount considerable, and the result often disappointing. Therefore, in the great majority of instances, there is no option but to have recourse after all to milk which is not of human origin; and the consensus of intelligent, educated, and scientific opinion is, that cow's milk had then best

be depended on for affording the required nutriment.

Cow's Milk.

Leaving the indefinable *human element* of mother's milk out of the question, cow's milk possesses all the essential proximate principles of food necessary for infant growth and development, and as compared with the milk of any other domesticated animal, is the best substitute for human milk.

The following table represents the composition per hundred parts of different milks.

	Woman	Cow	Ass	Goat
Casein, flesh-forming Proteid, etc.	2·7	4·2	1·7	5·5
Cream, Heat-giving Hydrocarbon	3·5	3·8	1·3	5·6
Sugar, Fat-making Carbohydrate	5·	3·8	4·5	3·6
Bone-formers, etc., Salts	2·	7·	5·	6·

From the above, it will be seen at a glance, that there is present in cow's milk very much more *casein* and *salts*, and less *sugar*, than in human milk.

In addition to these differences, it is known: First, that the casein of cow's milk forms

a larger, firmer, and more indigestible *curd* than the casein of human milk.

Secondly, that cow's milk, by the time it is delivered, has often become *acid*, whereas mother's milk is alkaline.

Thirdly, that cow's milk often teems with *microbes*, whereas mother's milk is free from them.

In some measure to remedy these defects and to adapt cow's milk to better suit new-born infants, it is necessary to reduce the percentage of casein and salts and increase the percentage of sugar. But to accurately accomplish this, necessitates a knowledge of chemistry and the possession of a laboratory; and though there are some reputable firms who supply milk thus prepared its cost is a bar to its universal use. Happily, however, it is well within the power of any mother by a little attention to modify ordinary cow's milk, for all practical purposes, to suit her baby.

To reduce the proporation of casein to one half, an equal quantity of water should be added to cow's milk; but, as this further reduces the proportion of its sugar and cream, 2 teaspoonfuls

of milk sugar and a tablespoonful of cream ought to be added to each pint of the mixture to bring it to the required standard.

The substitution of barley water for ordinary water, to mechanically prevent the formation of tough curds, and the addition of lime water to counteract any acidity is often also most useful.

The question as to whether milk should be *boiled* or not is one upon which considerable disagreement prevails. As mother's milk is not boiled, it follows if one could be certain of the purity of cow's milk, that also should not be boiled. Apart from its diminishing the actual nutritive value of milk, which it does, boiling certainly also alters the taste and *destroys* the "living principle" of milk: and babies fed for many months entirely upon boiled milk become pallid, do not as a rule thrive well, and are particularly liable to suffer from *rickets*, *convulsions* and *bronchitis*. On the other hand, the risk of conveying disease to an infant, by feeding it on uncooked cow's milk is not inconsiderable. Therefore, if it be decided to boil the milk, a little raw beef juice should occasionally be added to it, to obviate the ill

effects to which it is liable to give rise from the absence of "living principle" and sufficient salts of iron, etc.

"Sterilising" milk (by heating it for a few minutes short of boiling) and "Pasteurising" by heating it to a temperature of between 158° F. and 176° F. for half an hour, are also effectual ways to destroy most of the organisms of disease which milk might contain, and are preferred to boiling by many, as the loss of nutritive material is insignificant, if any, if either plan be adopted.

Goat's and asses' milk if suitably prepared, may, at times, be used instead of cow's milk, but they are expensive, and difficult to obtain. Further, asses' milk, which is poor in casein and in cream, though rich in salts, is only suitable, if unmodified, for very debilitated babies with weak digestions; and goats' milk, which is too rich in casein, cream, and salts, is, if unmodified, too hard to digest for any but the most robust and vigorous infants.

An infant should be fed as exclusively as possible upon milk until its sixth or seventh month of life, for until the period of "teething" it cannot digest starchy foods.

TIME.

A baby should be regularly fed for the first six weeks of life about every two hours during the day and about every four hours during the night; after which time the intervals may be increased to three or four hours during the day and six or eight hours during the night.

QUANTITY.

The quantity of milk an infant requires is less than often supposed, and the children of the "well-off" more often die, of over-feeding than under-feeding.

As at birth the *stomach* is only *large enough* to contain, without distension, *two tablespoonfuls* of fluid, this quantity of milk should not be exceeded, for each feed, for the first three days of life. Subsequent to the third day, and until the end of a fortnight, three tablespoonfuls will suffice ; from the fourteenth day to the end of the month, four ; and from the first month to the third, six, gradually increased to eight, are enough. After the fourth month undiluted cow's milk may usually be given with advantage to healthy children, and a couple of pints of

it ought to be consumed per day when the age of six months has been attained.

Absolute cleanliness is essential in the preparation of the milk and bottle for hand-fed children.

The bottle should be one which can be easily and thoroughly washed out, and be fitted with a nipple only.

The same régime will not of course suit all babies, and modifications of the above system of feeding may occasionally be required.

The following are the indications of defective feeding and nutrition.

If a child sicks up curds, it is either getting too much milk, or getting it too quickly, or getting it in too indigestible a form.

If a child passes curds and suffers from diarrhœa or constipation, the milk is too strong.

If a child digests its food, but wastes and is always hungry, it is having its milk either too poor or too diluted.

If a child gains in weight too slowly, too little sugar may be the cause.

If a child suffers from acidity, diarrhœa and green motions, too much sugar may be the cause.

Further, too little cream causes hard stools, and too much cream gives rise to vomiting, diarrhœa, and fatty soft motions.

If a baby takes its food well, sleeps well, gains weight, and is happy, leave well alone, for too much caution cannot be exercised in altering its diet.

It should not be forgotten that babies often cry because of thirst as well as of hunger, and a tablespoonful or so of warm water is the proper corrective for this, and can never do any harm.

Weaning.

The best time to wean a healthy infant is at the tenth or eleventh month, but it should not be done suddenly. And it may be well, if the baby is not progressing, from the seventh month to supplement the milk given, by the addition each day of a little feed of arrowroot, prepared barley, isinglass, sago, rusks, tops and bottoms, boiled bread, bread and milk, beef tea, or other such like preparations which are easy to digest and suitable to form a pap with milk.

Diet of Childhood.

From the age of twelve months upwards, as the teeth are cut and the child grows, the diet

requires to be gradually increased, and nourishing broths, lightly boiled eggs, bread and milk, oatmeal porridge, light puddings, well cooked vegetables, white fish, fresh meat, and ripe fruit may be gradually added to it with great advantage; for though milk and farinaceous foods should form the staple food of children until they have attained the age of about seven years, it is a mistake to restrict them too closely to such foods, for, there can be no doubt but that the best development of the body and mind is compatible only with *a good mixed and varied diet*, and it is well known, too, that Children and Infants *deprived of fresh animal and vegetable juices*, and fed all but exclusively on starches and boiled milk, become ill-nourished and frequently are the victims of *diarrhœa*, *bronchitis*, *convulsions* and *rickets*, or suffer from *scurvy*, *skin affection*, and other disorders.

Relative Amount of Food Required.

The quantity of food required both by Infants and Children is quite out of proportion to their weight, and this is due to the fact that during infancy and childhood growth proceeds at a far greater pace than during any other time of life,

and to maintain the equilibrium of the body provision has to be made *not only for replacing the structures which waste, but also for the constructive processes which are maintained in health.*

Infants and children, too, more rapidly lose heat than adults, in consequence of their presenting, in proportion to their weight and size, a much larger skin surface to the cooling influence of the atmosphere, and hence they require and thrive best on a diet composed of plenty of *fats and starches* (to warm them), mixed with a due proportion of *animal proteids* (flesh-formers) to build up their muscles and organic structures (*see* appendix or diet charts).

The following is the approximate amount of food required by a child compared with a man.

Under 2 years				$\frac{3}{10}$ths.
From	3	"	to 5	$\frac{4}{10}$ "
"	6	"	to 9	$\frac{5}{10}$ "

Children at the age of ten years require half and at the age of fourteen years an equivalent amount of nourishment to a woman. Young men who have not attained full growth require more food than adult men.

Adults require a sufficient mixed diet, which

ought to vary day by day, as sameness of food takes away the appetite and impairs the digestion.

As age advances and growth stops, less food is needed, and when the senile period of life is reached, the amount and nature of food required approximates more closely to that of childhood.

Sex.

A woman requires one third less food than a man, and female children perhaps a little less food than male children.

Stature.

Height and *Weight* are important factors also in determining the amount of food required. For instance, tall thin men, as compared with short stout ones, are at the disadvantage of not only having a larger surface of skin exposed to the cooling influence of the atmosphere, but also in being deficient in fat to keep the heat of their bodies from radiating. Hence, tall and thin people usually require more food than short or stout ones, and tall broad fat men than compact small fat men of equal weight.

Occupation.

Hard manual labourers require twice as much food as idlers, and brain workers require nearly as much food as labourers, though of a lighter and more digestible nature.

Climate.

In hot weather easily burnt up fatty food is to be avoided, and less flesh meat should be ingested, for, as most of the water from the system is discharged as perspiration by the skin, the kidneys are less active and cannot flush out perfectly the waste derived from animal proteids and juices; and therefore fruits, vegetables, cereals, and milk, constitute the most suitable articles of diet for warm climates and in hot weather.

More fluid in the form of beverages is needed in hot weather, to maintain the great loss of water by perspiration (which equalises the temperature of the body) and, at the same time, to enable the kidneys to clear the system of waste.

It is wrong, however, to drink to excess, as this, by unduly increasing the action of the skin, adds but to the discomforts of the heat.

Non-stimulating beverages, made of fresh lemons, or fruit juices and water, are best; and weak tea, which is a stimulant, to antagonise the enervating and exhausting effects of heat, is very useful. Sweet drinks and ices tend to aggravate thirst, and their cooling influence is but very temporary.

To quench thirst a glass of water, flavoured if desired, gradually sipped is more efficacious than three times the quantity of iced fluid gulped down; and, contrary to what might generally be supposed, water, at the temperature of the air, is more useful for this purpose than that cooled by ice to nearly freezing point. Further, the sudden chilling of the interior of the body with copious draughts of iced fluids, or even cold water, has frequently been the cause of *appendicitis* and other serious consequences.

In cold weather a greater abundance of every kind of food is essential, and fatty, oily, and greasy heat-giving substances are particularly suitable; as a proof of which, the inhabitants of the Arctic zones relish most the fattest blubber, and it is recorded on the best

authority that they partake of tallow candles with relish.

Number of Meals.

Three meals a day are ample. A good breakfast, a not too heavy mid-day meal, and a substantial repast when the labour of the day is over is best adapted to the requirements of most people.

An interval of about five hours between meals (to ensure the thorough digestion of the food taken) and of two hours between a meal and retiring to bed should be observed.

The correct nature of each meal in respect of its weight, and the proportion of flesh and starchy food it should contain, has been estimated thus :—

Cooked food required per day by an adult = 3 lbs. or 48 ozs., of which 2 lbs. (32 ozs.) should be of vegetable and 16 ozs. of animal origin.

Menu in Ounces.

	Breakfast		Dinner		Supper	
Animal food	$5\frac{1}{3}$	+	$10\frac{2}{3}$	+	0	= 16 ozs.
Vegetable food	$9\frac{1}{7}$	+	$13\frac{5}{7}$	+	$9\frac{1}{7}$	= 32 "
	$14\frac{10}{21}$	+	$23\frac{20}{21}$	+	$9\frac{1}{7}$	= 48 "

This régime will not, however, be found

to suit all people, for many individuals cannot and ought not to work very hard after a heavy mid-day meal.

Exercise and Food.

To favour digestion, active muscular or mental exercises should be avoided after eating; a leisurely walk is, however, beneficial.

It is useful to remember:—The blood circulates most freely in that organ which is most active, and therefore to unduly divert blood from the stomach to the brain or muscles after eating must always be harmful, and tend to arrest the digestion of food.

Dietetic Rules.

1. A wholesome diet of meat, fish, vegetables, and fruit is best.
2. Sameness of food cloys, and variety day by day is most wholesome.
3. Meat, fish, and poultry should be thoroughly cleaned and well cooked.
4. Vegetables should be steeped in salt and water, and well cleansed by running water before use.

5. Milk ought to be "sterilised" or boiled.
6. Three meals a day at regular intervals are necessary.
7. Sound teeth are essential to perfect digestion, for they triturate the food, and break up the starch granules of vegetables, and expose them to the digestive power of the saliva.
8. Slow mastication, and the absence of hurry, flurry and disturbing thoughts, contribute to good digestion.
9. Ingesting draughts of fluid with meals dilutes the digestive juices, and retards digestion, and therefore ought not to be indulged in. A small quantity of fluid may, however, be imbibed in sips to aid mastication if necessary.
10. After a meal, mental concentration and active physical exercise are hurtful, and should be avoided.
11. Cold food is less digestible and nourishing than warm food, but being less stimulating and heating is suitable for summer weather.
12. Boiled flesh is more digestible than roasted, but roasted is the more nourishing of the two.

13. Congenial companionship and pleasant associations promote the appetite, and the digestion and assimilation of food.

14. Cease eating previous to feeling satiated, for overloading the stomach interferes with its functional activity, and is a frequent cause of indigestion.

CHAPTER VII.

The Examination of Food.

The marked and characteristic features of good and bad food should be understood, so grave is the risk to health from eating unsuitable articles.

Butcher's Meat.

The flesh (muscle) should be dry, firm and elastic, of a deep red colour (except pork, veal and lamb), and marked with streaks of firm white fat. If pale and moist the animal was either young or diseased, or if purple may not have been slaughtered, but have died of disease.

Good meat is nicely streaked with fat and dries on the surface on standing for a day or so, and any juice which exudes is small in quantity and reddish only in tint (this usually occurs excessively with meat which has been frozen).

There should be an entire absence of unpleasant smell. Meat commencing to decompose has a sickly odour, is pale in colour and is alkaline in reaction—that is, it turns blue a piece of red litmus paper (which can be obtained of any chemist).

If meat be undergoing decomposition, a small quantity of it finely chopped up and well mixed with warm water will develop a characteristic odour, and a clean skewer pierced through it will also smell offensively.

Pouring hot water on *bad sausages* will also bring out the odour of decomposition.

If the flesh of cattle or pig contains small round white bodies of $\frac{1}{25}$ to $\frac{1}{4}$ inch in diameter, they may be the eggs which develop tapeworms in human beings. Very minute whitish specks in pig's flesh may indicate the presence of the trichina parasite which so often causes the terrible disease of *Trichinosis* on the Continent.

Bone marrow when sound is rosy red in colour, and is not punctated with discoloured spots.

Brine of salted meat should not be sour or offensive.

Poultry should be firm and well fed. The skin ought to be elastic, and of good colour; not soft, sodden, greenish and of an easily broken nature, and there should be an entire absence of any unpleasant odour.

Game is generally considered best when "high." To thus eat decomposing flesh requires a similar "taste" to that acquired by the Chinese, who much esteem "high eggs." It cannot certainly contribute to health when thus ingested.

Fish should be free from smell, firm to touch, and devoid of suspicious odour. The eyes ought to be clear and bright, and the gills fresh and red in colour.

Fruits and vegetables should be ripe and firm, of good colour and free from mould, decay, or unpleasant odour.

Flour.

Good flour is all but white and free from smell or mustiness. It is soft and powdery to the touch, and if of the best quality, will all but cohere when pressed together with the fingers. It also forms a stringy dough when mixed with water.

Oatmeal ought to be free from husks, and agreeable to smell and taste.

Bread.

Good bread is white in colour, agreeable to taste and smell, and possesses a firm white crumb permeated by small cavities.

Bread made of either bad yeast or flour, or rice, is usually heavy, sodden, and sour.

Milk.

Good milk is rich and white in colour; and, if allowed to stand in a narrow tall glass vessel for eight hours, should be free from deposit, but cream equivalent to $\frac{1}{10}$ of its depth should rise to its surface.

The specific gravity of fair milk (tested with a lactometer) is 1030; and, every 3 points less than this, usually indicates that the sample has been adulterated by ten per cent. of water. The addition of water also of course lessens the proportion of cream in milk.

The milk of cows for some days after calving is of high specific gravity and yellowish in colour, and ought not to be used, for it possesses indigestible, irritative, and purgative properties.

BUTTER.

Pure butter should be pleasant to taste, practically free from colour, and of a fairly firm consistence, and if melted in a long glass test tube, four-fifths of its depth should float on the water, and salts and curds deposited at the bottom of the vessel.

Butter is often adulterated with animal fat, and this makes it more difficult to melt.

The addition of milk to butter makes it softer and possibly more creamy or smoother to the taste, but it is false economy to buy such a mixture, even at an apparently cheap price, as it is deficient in nutritive value, wasteful and much more expensive in the end.

It stands to reason, to add to two lbs. of butter, worth 1/4 per lb., a pint of milk worth 2d—which many factors do—doesn't make the mixture worth 1/- a pound, as the following calculation shows—

	£	s.	d.
2 lbs. of butter at 1/4	£0	2	8
1¼ lbs. of milk (1 pint) at 2d	0	0	2
Thus 3¼ lbs. are worth	£0	2	10
Therefore one lb. is worth	£0	0	10½

Cheese.

Cheese is manufactured by separating the casein or flesh-forming element of milk by the addition of rennet which coagulates it.

When ripe for use cheese should be rich, creamy, and pleasant to eat. Cheese made from milk from which all the cream has been separated is hard, tough, leathery, and indigestible.

Eggs.

New-laid eggs of good size should weigh about eight to the lb. and when held up to the light are more transparent at their centres than at their ends. They should also sink in a vessel containing one pint of water to which two ounces of salt has been added.

Tea.

Good tea possesses a fragrant aroma, and when shaken up with cold water, and strained through muslin, deposits tea leaves only, unmixed with an undue amount of dust, sifting or adulteration of any sort.

Tea leaves are liver-coloured, small and elongated, and have a serrated edge.

Tea is a justly popular beverage, for it

possesses stimulating, refreshing, and restorative qualities, and promotes the action of the skin and kidneys if properly imbibed, by people with whom it agrees. It owes these virtues to the presence of the alkaloid *thein.* It also contains, however, *tannic* acid, which is soon dissolved out of its leaf by boiling water, and for this reason tea, when made, ought not to be allowed to stand more than 3 minutes. Tannic acid is the frequent cause of the indigestion of excessive tea drinkers, as it interferes with the action of the digestive juices. China tea contains less tannic acid than the Indian or Ceylon varieties, and is therefore a more suitable beverage for dyspeptic individuals.

If tea, however, be properly made, with water just boiling, in a heated pot, and allowed to draw for 3 minutes only, an excess of tannic acid will not likely be imbibed; and if thus brewed it be taken in moderation no harm is likely to result from its use, for a cup of it will not contain more than 2 grs. of tannic acid and 1 grain of thein. A pinch of bi-carbonate of soda is sometimes useful to neutralise the acidity of teas rich in acid.

Neurotic or nervous people very often cannot take tea on account of the action of the thein on them, and children for the same reason ought not to be given any.

Coffee.

Coffee is similar to tea in its action, for it also possesses an alkaloid *caffein*, which is all but identical to thein. Coffee, however, acts more on the intestines than on the skin and kidneys.

Notwithstanding that, as compared with tea, coffee contains but one-fourth of alkaloid, and one-seventh of the tannic acid, it is not such a generally esteemed beverage in this country. This no doubt is because coffee contains a greater amount of vegetable fat than tea, and therefore upsets "bilious people," and because few people know how to make it properly.

The principal adulteration used to fabricate coffee is chicory. But if a portion of the mixture suspected to contain it, be thrown into water, the chicory, if present, will sink to the bottom, and the coffee will float on the surface. Caking in the packet also indicates the presence of chicory.

Cocoa.

Cocoa is a favourite beverage with many, and a decoction made with the "nibs" (roasted seeds) is agreeable, stimulating, and refreshing, and free from rich fat. A mixture of the "nibs" crushed and manufactured with sugar, starches, and flavouring agents is sold as chocolate, etc.

Cocoa contains a similar alkaloid to tea and coffee called *theobromine*, but, on account of the presence in many of the mixtures sold, of too great an amount of vegetable fat and sugar it often disagrees with adults and bilious people. It is however a most useful beverage, and is certainly the best and most useful one I know for children, for they can digest it well, if it be pure and of good quality.

Cocoa, as compared with tea, is all but free from tannic acid, and as compared with coffee it contains twice as much alkaloid, and more fat. A genuine preparation of cocoa from which the fat has been separated, and to which an undue amount of starch and sugar has not been added, is undoubtedly the best beverage for those for whom tea and coffee is unsuitable.

Alcohol.

Alcohol cannot be classed as a food or beverage proper, for it neither sustains animal heat, nor does it build up the tissues of the body.

Subsequent to the initial nervous excitement and rush of blood which alcohol causes, the heat of the body is reduced (for the suffused skin parts with its heat very rapidly) and the mental faculties and functions of the body become depressed.

These facts are well known to arctic explorers, who deny it to their crews, for fear of their becoming frost-bitten and incapacitated. It has also been proved that men can accomplish more work on a non-alcoholic diet. Further, the regular ingestion of food is necessary to existence, and once the appetite is satisfied, all craving for food ceases, but the reverse is the case with alcohol; the more people have, the more they usually crave for.

CHAPTER VIII.

Cooking.

The effect of cooking is to make food more appetising and digestible. It develops flavour, breaks open the starch granules of vegetable food, and renders animal food tender, soft and gelatinous. Cooking also destroys the germs of disease.

Meat.

Roasting and Broiling are the most nourishing methods of cooking fresh meat. The heat employed should, however, be sufficient to quickly coagulate the albumin or proteid coating on its surface to retain the juices, and then be lessened, in order to cook it slowly, and not dry it up and diminish its nutritive qualities.

Boiled meat is more digestible, but 25% less nourishing than roasted meat. In boiling, to

retain the nourishment, substances should be plunged at once into boiling water, to coagulate the albuminious surface and then the cooking should proceed more slowly. The liquor should be used for soup, as it contains much nourishment (the 25%) and if properly prepared is stimulating and appetising.

Tough, sinewy meat is more tender when boiled than roasted, for the gelatin contained in the tissues is dissolved and softened by the heat which boiling sends right through it.

Baking.—Meat, cooked in an oven (unless it be kept scrupulously clean, and well ventilated) often develops unpleasant flavours, in consequence of burnt volatile particles becoming deposited on its surface. A double dripping pan (into the lower one of which water should be placed, to prevent the fat and dripping burning) will do much to obviate this.

Stewing requires a heat much below that of boiling water, to extract juices, and less liquid is necessary than in boiling. It is the cheapest and most economical method of cooking, as nothing is wasted; little fuel is required, and the toughest meats are rendered eatable by the

long continued heat and moisture to which they are subjected. As stewing, however, completely separates all the juices contained in meat, if the heat be excessive, they spoil. Stewed food is usually too rich and fatty for all except those possessed of a sound digestion.

FRYING is only a suitable process of cooking to adapt for tender meat, which can be cooked rapidly. When frying in oil or fat, the bubbling should cease before putting in the substance to be cooked, for the heat of the fluid will then be above that of boiling water, and will coagulate its surface with a firm coating, which will retain its nourishment. Cooks test this by dropping a piece of bread into the pan, the heat of the oil or fat in which should crisp it in half a minute if the temperature is high enough for frying.

RECOOKED FOOD undergoes chemical change, and is apt to disagree with many people; it is less digestible than freshly prepared food.

COLD FOOD is not as nourishing as hot food, but in summer it is more appetising and less heating. In winter cold food of course cannot

carry any heat (other than the body itself generates out of it) to the body and is hence of less food value.

Vegetables.

In cooking vegetables or fruits the same remarks in respect of heat generally apply.

To retain their nourishment and juices, considerable heat at first is necessary, and to extract them the reverse procedure should be adopted.

CHAPTER IX.

THE EFFECTS OF UNWHOLESOME AND UNSUITABLE FOOD UPON HEALTH.

Preserved Foods.

It has already been stated that an excess or deficiency of food, or the essential constituents thereof of food, may be productive of disease or a general depraved condition of health, and a predisposition to disease. In connection with these influences of food upon health, it must also be added that preserved foods of every kind are much inferior in nutritive value to the fresh products of nature, and are but poor substitutes for them.

MEAT EXTRACTS AND ESSENCES are practically devoid of any nutritive properties whatsoever, and the most that can be said of them is that they are stimulants, and by their stimulating

action may at times assist nature in bridging a crisis when other forms of nutriment cannot be ingested, or, in digesting substances which are of real nutritive value. An ounce of some of the best known and mostly advertised essences contain only a few grains of nitrogen, and, however much of them one ingested they could not support life. As a matter of fact, dogs have been found to live longer on a diet of pure water than on the most nourishing beef teas and meat extracts. Personally I have known hosts of poor people to beggar themselves by purchasing costly meat juices, when one tenth of the outlay expended on simple food and fresh milk would have been of infinitely greater service, and for this reason I desire to attract special attention to *this* subject.

Milk condensed or desiccated and prepared starchy foods, upon which many unfortunate infants are entirely brought up, are productive of two thirds of the illness due to lack of nutrition, which crowds our hospitals for children. Most of the "beautiful" examples of such feeding, who take prizes at baby shows, are

simply loaded with unhealthy fat; are devoid of blood, bone, and muscle; but too often are lacking in stamina to survive trivial ailments, and are the victims of RICKETS, DIARRHŒA, BRONCHITIS and CONVULSIONS. It is only, however, fair to mention that there are some brands of condensed milk which are suitable for infants when cow's milk disagrees with them and other methods fail; *but, even then, fresh meat or fruit juice ought to be included in their diet.* After the age of six months, too, many starchy preparations afford a most suitable addition to their menu.

Tinned Foods.

In the absence of fresh meat, vegetables, and fruit, tinned foods have often to be depended upon, but this is the only justification for their general use. Meat and fish thus preserved may contain poison due either to disease or decomposition, and all tinned articles are liable to impregnation by metallic poisons being dissolved out of tins in which they are packed, or from the solder with which they are sealed up.

In addition to which, poisons are often intentionally added as preservatives and colouring

agents, by unprincipled manufacturers. For instance, sulphate of copper is frequently added to preserve vegetables and to make them look green, fresh, and inviting. This adulteration may, however, be detected, by allowing a clean steel knife to stand in the suspected liquor for a short time, when copper, if present, will be deposited on the blade.

Poisoned Fresh Foods, etc.

The flesh of animals dead of disease, or poisoned with food or medicine, may cause disease in a human being. It is only, however, by studying the characteristics of healthy flesh, by dealing with reputable tradesmen, and by thoroughly cleansing and cooking food that danger can be lessened and that such diseases as consumption, intestinal worms, and many other ailments may be absolutely assured against and be stopped from spreading in this way.

Putrid Food.

Every kind of putrefying animal food is liable to cause illness or *ptomaine* poisoning, and the blood of animals made into puddings

is particularly dangerous to consume for the same reason.

Sausages are very unsafe to eat because meat which may not be fresh, or good enough to dispose of openly, can be disguised by flavouring; and further, the intestinal skins which wrap up these "mysterious" products are often tainted with the germs of disease.

Symptoms.

Though food poisoning often attacks immediately on its ingestion with all the signs and symptons of a disturbed stomach, these indications may be delayed for a couple of days. Sickness, vomiting, diarrhœa, cramps, feverishness, and thirst may mark the onset of such an illness, which, if not checked, may cause speedy collapse and death. The skin, too, is often covered by a rash similar to that of scarlet fever, or that caused by stinging nettles.

Fish.

Shellfish (such as lobsters, crabs, and mussels), often, in warm weather, upsets the stomach and intestines, and causes swelling of the tongue, throat, and eyelids; a widely diffused

skin eruption, and similar symptons to those described above.

Oysters are often impregnated with the microbes of typhoid fever, and when taken from beds near sewage outfalls, have been known to cause widespread epidemics of that disease.

Mussels may also be diseased, or similarly contaminated to oysters, or cause metallic poisoning by people ingesting the copper absorbed by them from the piers to which they cling.

Salmon, eels, herrings, mackerel and the liver of halibut, *and all fish out of season*, and too large, fat and overgrown, is liable also to cause illness.

Vegetables.

Decomposing and mouldy vegetables, and unripe fruits, set up disturbances of the stomach and intestines, characterised by sickness, vomiting, diarrhœa, etc.

Water cress, salads and all vegetables, eaten uncooked, should be allowed to stand in salt water and be thoroughly washed in running water before use; for the microbes of *typhoid fever*, *diphtheria*, *diarrhœa* and other zymotic diseases, and the eggs of *thread* and other

intestinal worms and parasites, can be contracted by ingesting unclean vegetable food.

Milk.

Milk is perhaps the most general food medium by which disease is transmitted. The germs of diseases to which cows are liable, or poisons which they have taken either as food or medicine, can contaminate their milk, and poison those who ingest it. The milk of cows suffering from foot-and-mouth disease, anthrax and *consumption;* and of cows which have eaten the leaves of the poison oak, or meadow saffron, or have been fed on brewer's grains, sometimes convey disease to human beings. It is also believed by many that cases of *scarlet fever* and *diphtheria* frequently owe their origin to the drinking of milk of cows affected by modified forms of these diseases.

Milk may also become contaminated by the hands of the milkers, the hair and dirt of cows, or the germs of such diseases as glanders, or influenza, affecting horses or other animals stabled in close proximity to cows.

Milk, too, easily absorbs and becomes contaminated by foul air, putrefactive gases, and dirt of every sort.

It is also at times poisoned by the metallic vessels in which it is contained; zinc, copper, and lead vessels, being the most dangerous, in this respect, and enamelled iron the least dangerous.

The spread of epidemics by milk usually results from the microbes of human infective diseases gaining entrance to it from the air, or by means of the water used to adulterate it, or to wash the utensils which contain it. For milk being a typical food, affords a most perfect diet for microbes to live, develop, and multiply upon, and for this reason it soon teems with millions of microbes, once a few have gained access to it, and disseminates infective diseases.

Tainted milk soon also becomes contaminated by the fermentation *fungi* ever present in the air, and hence causes *thrush* and *infantile diarrhœa* very frequently.

It may indeed, unfortunately, be assumed, with every probability of certainty, that all water borne, air borne, and food borne, infective and other diseases, may, without exception, under suitable conditions, be carried and spread by impure milk.

The foregoing are serious imputations to

make against such a widespread, highly prized and justly valuable and indispensible article of diet, but, as hundreds of epidemics of disease have been traced to milk supplies, it is well to be cognisant of the danger of ingesting contaminated milk so that precautions can be taken to obviate the occurrence of those diseases to which milk is known at times to give rise.

Of all diseases, *infantile diarrhœa* is the one which kills the greatest number of children, and that it is principally due to contaminated milk is unquestionable, so were it for no other reason, the subject of our milk supply should merit the closest attention.

The chief characteristics of a milk epidemic are :—

1. Sudden outbreak.

2. Many people occupying different houses simultaneously attacked.

3. Two or more people attacked at the same time in a house.

4. Children and those who drink most milk being more numerously affected than those who drink least.

5. All attacked partaking of the same milk supply.

Preventive Measures.

To ensure an uncontaminated milk supply is not an easy matter, but to antagonise the dangers of such is not difficult. The source of one's supply is of course beyond control, and all that can be done upon that point is to satisfy oneself that milk is being purchased of a reputable vendor, who possesses a dairy fitted in accordance with the latest modern sanitary requirements. Happily also if milk be contaminated, practically all the microbes of infective diseases can be killed by boiling it.

Boiling milk, however, removes some of its flesh and fat-forming elements (which rise as "scum") and makes it less palatable and digestible. To obviate these disadvantages, milk may be satisfactorily "sterilised" by putting it into a stout glass bottle which is then placed for twenty minutes in a pot of water kept boiling. Whilst exposed to the heat of the water, the neck of the bottle should be loosely plugged with cotton wool, and when its contents is "sterilised," stoppered tightly with a sound clean cork. By this method, as the milk is never heated to boiling point, it does not taste cooked. If it be desired, however, to keep milk for more

than a day, it should be either "sterilised" for a longer period, or the process should be repeated at intervals. The milk may also with advantage be strained before boiling or "sterilising" it, through several layers of clean gauze (to separate hairs, dirt, and other particles), and when "sterilised" stored in a clean cool larder. Thus prepared, milk may be consumed with all but perfect safety.

Cheese, Butter, and Cream.

Cheese, butter, or cream, which has undergone fermentation, may give rise to *tyrotoxicon* poisoning. This is indicated by sickness, vomiting, diarrhœa, colicy pains, exhaustion, and general symptoms of food poisoning.

Beyond, perhaps, tasting acid or sour, articles containing tyrotoxicon are not necessarily altered in appearance or flavour.

Food-Poisoning Epidemics.

In connection with food-poisoning epidemics the same characteristics as in milk epidemics are common if the term "food" be substituted for "milk," "all" for "children," and "eat" for "drink."

CHAPTER X.

Food in Disease.

Though medicine may be essential in the treatment of disease, it does not take the place of food, for it cannot supply nutritive material to repair the waste which attends every thought and act of life.

Very few people know how to feed an invalid, because the art of doing so is supposed either to be so simple that its study is unnecessary, or that it is too difficult for anyone but a trained nurse to acquire. As a matter of fact, however, the truth lies between these two extremes, and any person who will exercise a little consideration and common sense need not have any difficulty in mastering the subject. The indications to guide one are similar to those which obtain in health, viz., to contrive that the supply of food shall approximate as closely as possible

to the demand for it, and to the excessive waste which characterises disease.

The difficulties to overcome in accomplishing this are sometimes insurmountable, because though the demand may be supplied, yet the organs of digestion and assimilation often fail to utilise the nutritive materials ingested. Another reason is that though the different organs of the body are beautifully endowed with special functions, they are linked together by the nervous system which co-ordinates their activities and renders them to an extent interdependent upon each other, and when the excretory organs fail to discharge waste, the organs of digestion, absorption, and assimilation fail also to execute their reparative functions of supply. In a word:—In disease the equilibrium of the body is upset, and to try and re-establish it is the object to endeavour to attain. As a proof of which, all diseases disturb equilibrium in proportion to their gravity, and according to the importance of the organ attacked; and loss of body weight is usually the most common and early indication of a serious affliction. Not only by reason of the foregoing circumstances is it quite impossible to

lay down any hard and fast rule to follow in the dieting of invalids, but also because invalids differ in their tastes—and certain diseases, to be hereafter mentioned, are benefited only by certain classes of food. For general guidance it is, however, happily, safe to formulate certain principles (to which there are but few, if any, exceptions), which may be always observed, for they are based on the knowledge that the vital activity of the organism is defective in disease, and that the strain to which it must be subjected should be as slight as possible.

The questions which must first arise in every case are—

Shall food be given?
How shall food be given?
What quality of food shall be given?
What quantity of food shall be given?
How often shall food be given?
At what hour shall food be given?

Shall food be given?

In many cases it is well, for perhaps twenty-four hours, not to give any food at all. For instance, in cases of gastric irritation—the result of overfeeding—or when everything given is

rejected, and if retained for a time, causes pain, diarrhœa, colic, or great discomfort, it is a mistake to irritate or further perhaps overload the stomach.

In such cases, an occasional tablespoonful of hot water with a few grains of bi-carbonate of soda, or a small piece of ice placed in the mouth at intervals, will suffice until the more urgent symptoms have subsided.

How shall food be given?

In as fluid a state as possible, and by the mouth if practicable.

The alternatives of feeding by the mouth are imperative in some cases. In refractory patients who refuse to take food, or in cases where obstructive diseases affect the upper passages or throat, a fine rubber tube inserted through the nose or mouth down to the gullet or into the stomach has often to be resorted to for the purpose of conveying nourishment to keep them alive.

Again in conditions of extreme gravity, obstructive, inflammatory, or otherwise, attacking the gullet, stomach, intestines, or other organs, injecting nourishment into the lower

bowel (Rectum) is frequently imperatively required to support life.

The foods given by the foregoing methods need differ in no particular from those suitable for ordinary fluid feeding by the mouth, except that for rectal feeding quantities of the most concentrated and usually predigested fluid foods, not exceeding a wine-glassful, are syringed into the bowel at blood heat about every three hours, or even more frequently if retained. And in feeding through a stomach tube predigestion is also usually indicated.

It is necessary, in rectal feeding also, to wash the bowel out each day with soapy water, so that the nourishment thus given may be easily absorbed into the system.

What quality of food shall be given?

The foods which are the easiest of digestion are the best; and a reference to the table already given, or at the end of the Appendix, will indicate them pretty fully.

If, however, the capacity to digest food is in abeyance, then *Proteids* may be predigested by *Pepsin*, *Starches* by *Diastase*, and *Fats* by *Pancreatin;* the directions how to use these

products will be found on the vials containing them, etc. (*see* appendix.)

MILK.

Of all foods, "sterilised" milk is the best, and is the *sheet anchor* to rely on for invalid feeding. A patient, whose diet scale is based upon 3 or 4 pints of milk a day need not be the cause of very much anxiety in respect to the lack of nourishment. For in the event of milk disagreeing, it may invariably be modified and made digestible :—

First—If it be too *fat*, the cream may be digested by the addition of *pancreatin.*

Secondly—If its *casein* is indigestible and forms large and tough curds, *pepsin* may be added to digest it, or *barley water* to mechanically separate the curd into smaller particles.

Thirdly—If it is *not* sufficiently *nourishing*, it can be enriched by cream, white of eggs, or *whipped* eggs, etc.

Fourthly—If by reason of "sterilisation" and deficient iron salts, it fails to support nutrition, *raw beef juice* may be added to it.

By referring to the section which treats upon the influence of milk upon ill-nourished

babies, it will be understood how the results of the above conditions may be recognised, and how best to alter milk for infant and invalid feeding.

A pint of milk contains nutriment equivalent, approximately, to three-fourths of an ounce of cheese and a little less than this weight of butter, and of sugar, with a teaspoonful of nourishing salts; and, as it contains all the elements of nutrition required for the sustenance of the body (except iron salts) in perfect proportion to each other, every effort should always be made to adapt it to suit an invalid; and should it pall upon the patient, the addition of a little cinnamon, nutmeg, vanilla, or other flavouring may render it more acceptable.

Soda water effectually serves for diluting milk if flatulence be not present; and the addition of lime-water, or a few grains of bi-carbonate of soda often makes it more acceptable to the palate, less acid, and also more digestible.

In very grave cases where even milk cannot be digested or retained, notwithstanding all endeavours to modify it, then, either whey, or the white of an egg mixed with half

a pint of water, or barley water, or beef juice, may serve to sustain the body until more nourishment can be taken, if the animal heat be in the meantime well maintained by hot bottles, and warm coverings.

Broths.

In addition to milk, in ordinary cases, mutton, chicken, and veal broths often serve as useful additions to vary the diet of an invalid, though they possess far less nourishing than stimulating qualities; and very little indeed of either. Broths are, however, not always suitable and are particularly liable to disagree and cause diarrhœa in cases of typhoid fever, and other conditions due to intestinal irritation, and, therefore, sight should not be lost of these facts.

Farinaceous Food.

Next to milk, farinaceous foods are the best on which to rely to sustain invalids, for they are nourishing and easy of digestion, and serve admirably to enrich milk or broths, and rice, sago, tapioca, cornflour, arrowroot. Barley is perhaps the most useful product of the vegetable world with which to feed patients when starchy food is indicated.

Eggs and Jellies.

Whipped eggs (raw) are very nourishing; and jellies and isinglass are often gratefully received by invalids, and benefit them to some little extent, for though they probably do not serve to build up new tissue, they conserve and save, in some measure, the waste of that which is already formed.

When convalescence is established, the diet needs to be more substantial and less fluid in its nature; and additions should cautiously be made to it, until that food which is suitable for a healthy person can be digested, with comfort and benefit.

What quantity of food shall be given?

As much as a patient will retain, digest, and benefit by. But as the amount of same varies considerably for different individuals, and in different diseases, close observation is necessary to ascertain, in any particular instance, the quantity essential to the welfare of the patient.

An invalid is benefited by the amount of food he digests, not by the amount he swallows, and, therefore, the exercise of undue zeal in forcing

nourishment upon him is more dangerous than giving him too little, or at times, even none at all.

Speaking generally, a daily régime of three pints of milk, one pint of broth, a couple of raw eggs, and a little farinaceous food, given in quantities of not more than a small cupful at a time will amply suffice in all ordinary cases, and need scarcely ever be exceeded in any case whilst on a fluid diet.

How often shall food be given?

Frequent feeding with small quantities of nourishment is always the best principle to follow in all cases of illness. About every two hours during the day, and every three hours at night—unless the patient be wakeful and exhausted, when he may be fed quite as often as by day—may be accepted as a good plan to adopt. In grave cases, where very small quantities of fluid nourishment can only be taken at a time, almost constant feeding in tablespoonfuls may be required; and as in such serious instances of disease not more than four ounces (8 tablespoonfuls) of food is likely to be assimilated every two hours, to exceed this

quantity is all but useless; unless, giving more does not disturb and also benefits the patient.

If, of course, food be craved for, and it is not rejected, one's discretion must always be exercised and the quantity advised exceeded when necessary.

At what hour should food be given?

At all hours if the patient is awake and needs nourishment, for except under special circumstances only should the sleep of an invalid be disturbed more frequently than is absolutely necessary.

When patients are convalescent, but before they have recovered their strength sufficiently, nourishment should always be given to them at least an hour *before they rise* in the morning, and when they have *returned to bed* in the afternoon in preference to other times; for when the body is at rest the digestive organs can utilise more of their energy in the discharge of their functions.

In every case of disease the closest attention must be paid to the action of the *bowels*, *kidneys*, *skin* and *lungs*; for these are the organs

which discharge the waste products from the body, and it is principally upon their activity that the amount and the nature of the diet required in any particular case depends.

Suitable Diets for Certain Diseases.

As the foregoing system of invalid dieting requires to be either very rigorously adhered to or carefully modified, in certain conditions of ill-health, I purpose now briefly to indicate some of the diseases which require special mention in this respect.

Fevers.

A fluid milk, and farinaceous diet, with a small quantity of broth, and a little barley water, plain water, toast water, or lemon water (sweetened slightly) to allay thirst, is most suitable until the crisis is passed.

At the outset of a fever, and before its nature is pronounced, solid food of every kind should be absolutely withheld; for in *typhoid fever* solid food often has caused a fatal rupture of the bowels.

Acute Rheumatism.

The diet should be as indicated for fever, and given liberally, but in small quantities, for as the heart is often seriously attacked in this disease care should be taken not to overload the stomach and thus injuriously affect it. Lemon drinks are useful to allay thirst, as lemon juice is believed by many to be useful in neutralising the acidity of the blood.

Gout.

In gout, the kidneys, which discharge most of the nitrogenous waste from the system, are usually at fault, and hence a non-proteid diet is best. A lacto-vegetarian diet composed of milk, farinaceous foods, and green vegetables; and the avoidance of sugar, sweet juices, alcohol, and tea, should be adopted. Whisky, well diluted, is the least objectionable form of alcoholic stimulant to give; and of starchy foods, potatoes are the most likely to disagree. As conditions improve, white fish, boiled or roast mutton or chicken may be ingested, but condiments and spices should be eschewed as long as possible; and such articles of diet

as veal and pork ought seldom, if ever, be partaken of by gouty subjects.

Rickets.

This disease is generally due to children being fed upon a too exclusive diet of *boiled or condensed milk and starches.* New milk, lime water, fresh fruit juices, and raw beef juice contain the salts necessary for the proper consolidation of growing bones, and may be given liberally with great advantage, both for prevention and cure of rickets (*see* "Infant Feeding.")

Scurvy.

Fresh meat, vegetables, or fruit juices must be included in a diet to obviate the occurrence of scurvy, or to cure it.

Scurvy-rickets has recently become a rather common condition in England, and it is all but confined to babies who are brought up by hand and are improperly fed on boiled milk and starchy food only.

Diabetes.

This disease is characterised by the elimination by the kidneys of immense quantities of water containing much grape sugar, and

often also by great wasting of the body; for the sugar, into which all ingested starch is converted by the processes of digestion, passes out of the system unaltered, instead of being stored up as *Glycogen* by the liver, and utilised to repair the waste, and add to nutrition and development of the body.

Many cases of diabetes are only benefited when rigorously kept on a non-starchy diet, the loss of the heat-giving qualities of which is compensated by a liberal substitution of fatty and proteid articles. As opinions, however, differ as to the general application of this system, the physician in attendance upon a case is the one to decide whether it be suitable for his patient.

The following is the diet usually considered most suitable for a victim of this unhappy malady.

May be Eaten.

(1) ANIMAL FOOD.

Fresh meats of all kind.
Ham, bacon, and tongue.
Poultry, game, fish.
Soups and essences.
Eggs, cheese, cream.

(2) CEREAL FOOD.

Gluten bread.
Almond bread.
Diabetic non-starchy biscuits.

(3) VEGETABLE FOOD.

Spinach, water cress.
Mustard and cress.
Green lettuce, cucumber, mushrooms.
All green parts of vegetables.

Doubtful.

(But may be given to a not very severe case, if boiled in plenty of water.)

Cauliflower, broccoli, turnips, sprouts.
Asparagus, marrow, and green beans.

The following articles

May Not be Eaten.

Bread and biscuits, and cakes made of ordinary flour.
Rice, arrowroot, sago, tapioca, macaroni, vermicelli.
Potatoes, carrots, parsnips, tomatoes, peas, beans.
Scarlet runners, cabbages, artichokes, endive, beetroots.
Fruits, sweets, preserves.

Beverages.

Not milk, as it contains sugar. Alcohol is also contraindicated, but either a dry wine, a whisky, or a brandy is the least objectionable

form of an intoxicant to give, if the patient will not be denied.

Natural mineral waters and soda water, and tea and coffee in moderation are harmless. Chocolates (cocoa prepared with sugar and starches) are to be avoided, but a decoction of cocoa nibs (freshly roasted) is stimulating and beneficial.

Anæmia.

Anæmia and other diseases due to an impoverished condition of the blood, and lack of iron in it, are benefited by a liberal supply of milk, underdone flesh meat, tender green vegetables, and ripe fruits, if the organs of digestion and assimilation are not injuriously affected by solids. It is necessary to be mindful of the last observation, for many young women who suffer from Anæmia are also affected by "gastric ulceration," and they, of course, should *avoid solids* until better.

Diseases of the Throat, Nose, Upper Air Passages, and Gullet.

Small quantities, frequently given, of easily digested fluid or semi-fluid foods agree best.

Those who suffer from certain diseases of the throat and *paralytic* conditions often can swallow bread and milk better than milk alone, and this should be borne in mind.

Diseases of the Lungs.

A diet similar to that suitable for fevers is indicated in the acute inflammatory stages of all lung diseases: But when fluid has collected round the lungs (as in pleurisy), limiting the supply of drink is sometimes most useful and curative in its effect.

In chronic affections of the lungs and consumption, all the most digestible and nourishing articles of diet and cod-liver oil should be partaken of; for it is only by the ingestion of *good food*—plenty of milk, eggs and cream, and underdone meats, tender green vegetables, ripe fruits, and nutritious sweets—and an abundance of *fresh air* and *rest* that a cure is to be effected.

Consumption.

The rationale of the correct treatment for Consumption is to supply, if possible, more than sufficient food or fuel to counteract the

waste which this disease causes, until the normal weight of the body is re-established.

As exercise increases the combustion of the tissues of the body, more exercise should not be taken by a consumptive than is absolutely necessary to improve the functional activity of his body, and hence *rest* is such an important part of the cure.

The best régime is as follows :—

Half an hour before rising. 7.30 a.m., a glass of milk in which a raw egg is whipped, or to which some cream is added.

Breakfast, 9 a.m. Oatmeal porridge or some farinaceous food. Fat bacon and egg or ham, or a chop, steak, or some fish. Sweet fruits in season. Bread and butter, or well-buttered toast. Cocoa, coffee, or tea in moderation.

Between breakfast and dinner, 11.30 a.m. Large glasses of milk with barley or lime-water; or a cup of strong broth with an egg or piece of toast, or a couple of sandwiches of finely-scraped raw beef.

Dinner, 1.30 p.m. Fish, meat, vegetables, farinaceous, milk or egg puddings, sweet fruits and cream, bread and butter.

Afternoon meal, 4 p.m. Same as at 11.30 a.m.

Tea, 6 p.m. Boiled sole or other white fish, lightly boiled new-laid eggs, buttered toast and bread, tea, coffee, or cocoa with plenty of milk or cream, or a little chicken with ham or cold boiled bacon.

9 p.m. A cup of strong broth or, better still, a basin of farinaceous food with milk and cream, with the addition of as much "sterilised milk" as a patient can digest comfortably.

The above dietetic outline is a good one which may be modified at times with advantage to suit the taste of a patient; and if such a full diet disagrees it must of course be diminished.

It is essential that such a liberal diet scale should be gradually and carefully arrived at; and never be given to the extent of upsetting the digestive functions which unfortunately but too often occur and defeat the aim over-zealous nurses desire to attain. To guard against this, strict attention must be paid to the regular action of the bowels by giving an occasional aperient or an after-dinner pill; or a dose of diastase, pepsin, or pancreatin (or all three combined) after food, will often be found useful in assisting the stomach to digest the starches,

sugars, proteids, and fats contained in the foods suggested; and a simple bitter stomachic tonic may often be useful to sustain the appetite; but these considerations had always be better referred to the physician.

Poor people, who cannot afford to secure such an expensive diet as that indicated, may do equally well on a less costly one. Probably the cheapest foods from which to obtain the elements necessary for nutrition are as follows:—

Proteids, flesh-formers.—Peas, flour, oatmeal, bread, cheese, skim-milk, potatoes, beef steak, white fish.

Starches, fat-formers.—Peas, flour, oatmeal, bread, potatoes, rice, barley, and sugar.

Fats.—Suet, dripping, margarine, butter.—

If four pints of milk form the basis of the day's diet, and strong pea soup (made with bones and vegetables) and a small quantity of meat, bacon, fish, suet, and sugar, represent the additions to it, then a sufficiently inexpensive diet may perhaps be constructed.

It is a favourable omen if the body weight increases from week to week in consumption, but it is neither necessary nor is it an advantage that it should do so too rapidly, for when such

happens the body is being merely loaded with fat, which adds to the burden the lungs, heart and muscles have to bear. I have seen many consumptives who, by a system of what can be fairly termed "*stall feeding,*" *and abstinence from all exercise*, put on an excessive amount of unhealthy fat and suffered in consequence from greater shortness of breath and weakness than before treatment.

The aim then should be, to give only as much digestible nourishment, and urge as little exercise as will contribute to the comfort and gradual increase weight of a consumptive.

Air.

Air is food for the lungs, and as the air out of doors is always purer than that within, to be in the open air and sunshine, as much as possible, is essential to the welfare of one afflicted with Phthisis or Consumption.

When it is not possible to lie down or to walk in the open air, in consequence of climatic conditions or otherwise, the invalid's room should be well ventilated, and be kept scrupulously clean and free from draughts. It should also be provided with as little furniture and as few

draperies as possible (for furniture occupies air space, and draperies harbour dust and disease). The floor should be washed daily, and covered only by easily shaken rugs, or linoleum; and the sun's rays (which are fatal to microbes) should never, if possible, be shut out of the room.

N.B.—Unconsumed food should at once be removed from sick rooms and burnt or destroyed, for in food microbes multiply, and from and to food flies carry the organisms by which diseases are spread.

Diseases of the Heart and Circulation.

To avoid overloading the stomach with food, and the blood vessels with fluid, is to diminish the work of the heart and rest it. Hence nutritious digestible foods of a mixed variety, in smaller quantities, and at more frequent intervals than during health should be given to sufferers from heart affections. Tea and coffee should only be given in moderation, and alcohol had better be withheld unless specially indicated as a medicine.

Disease of the Mouth and Throat.

Nutritious fluid, or semi-fluid foods, free from salt and irritating condiments, are the most beneficial.

N. B.—Aerated waters often irritate and keep up inflammatory lesions of the mouth by reason of the acids they contain.

Disease of the Stomach.

Acute Indigestion.

As little nourishment as possible and that of as easily digestible a nature as can be procured should only be given until the urgent symptons have subsided. In cases of acute indigestion, from overloading the stomach, or when as the result of some irritation, the vomiting and sickness is severe, an occasional tablespoonful of hot water with a few grains of bi-carbonate of soda in it, or a piece of ice, or a little soda water, or some barley water, will often suffice to sustain a patient for the first 24 hours, or until his stomach is more at rest. Careful subsequent dieting on an ascending scale will be required to restore to health and vigour.

Chronic Indigestion.

There are so many forms of indigestion that it is only by carefully ascertaining the origin and nature of an attack that it is possible to decide upon the scale or form of diet that will

suit a particular case best. Primarily, it is, however, essential to success to remove any obvious cause of the malady.

Teeth must be attended to if defective; mastication must be more deliberate, if faulty; and mental preoccupation, hurry and flurry, and exercise too soon after meals, given up if indulged in; and if these measures are adopted, when necessary—regular, nutritious, digestible, varied, and moderate meals will often effect a cure when all else fails.

In regulating the diet, particular care also must be taken to notice whether it is the *starchy* or *animal* constituents of food which cause discomfort, for there are some people who can digest a chop, yet fail to assimilate even a cup of cornflour; and, again, some forms of starchy food may agree, whereas others do not. Rice, for instance, suits many people to whom potatoes are harmful, yet both contain starch and are farinaceous foods. A perusal of Beaumont's table will perhaps serve to make my meaning clearer upon these points.

ATONIC DYSPEPSIA, which is usually accompanied by debility, nervous depression and flatulence, is best treated by small nutritious

and frequent meals. Tea, coffee, green vegetables, potatoes, parsnips, carrots and turnips, usually disagree with sufferers, and aggravate their discomfort and condition.

ACID DYSPEPSIA, characterised by "heart burn" and a sinking feeling in the pit of the stomach, which is often *much relieved by taking food* is as a rule best treated by a diet of milk, fish, and easily digested meats, for starchy foods and sweets often increase the discomfort and acidity. Frequent, small nutritious meals are particularly useful in these cases, and when the "sinking" is urgent, a small glass of egg and milk, or milk alone, will often cause it to subside at once, and is far preferable to loading the stomach with doses of bi-carbonate of soda.

IN ALL CASES OF DYSPEPSIA avoid alcohol, tea, coffee, sweets, indigestible meats. Such vegetables as parsnips, carrots, turnips, and cabbages; (which cause flatulence) and condiments, which irritate the mucous membrane of the stomach, had also better be avoided as much as possible.

By referring to the tables of digestibility, a better and more useful knowledge of the dietetic treatment of dyspepsia may be gained.

It may be as well also here again to point out that fluid taken with food usually delays its digestion by diluting, and thus diminishing the physiological and chemical activity of the digestive juices.

Organic Disease of the Stomach and Intestines.

In serious diseases of the stomach and intestines, such as ulcerations, etc., feeding by the mouth may be out of the question, and rectal feeding then must be resorted to; the method to accomplish this has already been described.

When, however, food may be given by the mouth, very small quantities of the most nutritious and digestible fluid substances are the most suitable; and solids of every description must be eschewed until they are considered safe to be ingested. When the proper period has arrived, a gradually ascending scale of farinaceous, fish, and meat diet may be guardedly commenced and continued. But, all through life, a person who has once been the victim of an ulcer of the stomach should only partake of the most nutritions and digestible food, and should

be moderate in the use of alcohol, tea, condiments, and sweets.

Disease of the Liver.

The victims of either inorganic ("sluggish") or organic (structural) diseases of the liver thrive best on a light lacto-vegetarian or fish diet, with occasional small portions of tender roasted or boiled meat if necessary. Fatty foods, potatoes, sweets, sugars, alcohol, coffee, cocoa, condiments, and spices are to be avoided as much as possible.

Disease of the Kidneys.

As the kidneys discharge from the body the waste product of proteid digestion, animal foods are contraindicated, and, therefore, milk, farinaceous, and light fish foods suit best.

Alcohol is particularly hurtful to those afflicted with kidney disease; and as all spices, condiments, and other substances which irritate the mouth, also affect the tubes of the kidneys, they are to be avoided.

The ingestion of sufficient fluid is necessary to flush out the kidneys, but too much increases the strain upon them.

Diseases of the Nervous System.

The nutrition of the body is best maintained in nervous diseases by light food easy of digestion, taken in small quantities at frequent intervals. Of proteid foods, fish is believed by many to be of more service than butcher's meat, but as a matter of fact, beyond fish being less stimulating than meat this assumption is unwarranted. A mostly lacto-vegetarian diet is admirably adapted for chronic nervous diseases; and for functional diseases of the Nervous System, much benefit often results from a diet mostly composed of milk, taken in small and gradually increasing quantities—until six pints a day are consumed in addition to an ordinary allowance of food. This treatment combined with *Seclusion*, *Rest* and *Massage* is known as Weir Mitchell's.

In the more serious nerve disorders a fever scale of diet suits best, which, as the patient improves, may be gradually increased in quantity and quality.

COMA:—When unconsciousness is present great care must be taken with respect to feeding by the mouth; for many patients have been either choked, or have suffered from inflamma-

tion of the lungs, in consequence of the food given passing down the windpipe (larynx) instead of down the gullet (œsophagus).

Obesity.

Obesity is a condition which is characterised by an unusual deposit of fat in those parts of the body where some fat is normally found in health, and varies in degree according to its source of origin.

MODERATE OBESITY, due to heredity, or coincident with the period of childhood and middle life, not attended by any functional derangement of the system, is not a disease, and, as a rule, requires only a carefully arranged, slightly modified, diet, and a sufficient amount of exercise to relieve. The correct diet for that form of obesity, which is due to excessive eating and indolence, is also quite obvious.

ABNORMAL OBESITY :—There are, however, cases of obesity which belong to neither of the above classes, and in which the deposit of fat throughout the tissues of the body is so excessive as to interfere with its functions and to constitute a disease. In such conditions, treat-

ment is imperative to arrest, or, if possible, to cure the disorder; for the excessive strain which the weighty body puts upon an already weakened heart loaded with fat, is of serious import.

The disease is, however, one which requires careful treatment and only a physician is competent to undertake its cure; and those who are foolishly led by the fraudulent advertisements of quacks to submit to their devices run graver risks than they imagine. These gentry prey upon the credulity of the weak (ignorant and educated alike) and usually prescribe too rigorous a diet, and that which is worse still, poisonous, lowering drugs which further diminish both the power of the heart to fulfil its function, and the mental and bodily energy of the victim to resist their importunities.

The hygienic treatment for obesity may be summarised as follows :—

Little drink, much exercise.
Lean meat, bulky non-starchy vegetables.
No sugar, little fat, no alcohol.

Saxin may be used instead of sugar, and thin toast or bulky light water biscuits in lieu of bread.

Practically a diabetic diet with most of the fat excluded is well adapted for obese individuals.

In the matter of special diets many different systems have, and are, from time to time lauded as panaceas for Obesity. In whichever way they may vary, however, all of them aim at limiting the ingestion of fat-forming foods.

The Banting régime, which is, perhaps, the best known and most popular of all, consists essentially, in abstaining from *milk*, *butter*, *sugar*, *fat* and *potatoes*, and subsisting on a daily diet composed approximately of—

Meat or Fish,	15	oz
Fruit,	3	"
Vegetables,	4	"
Beverages,	35	"

Thus, though proteids are increased, starches, sugars and fats are practically eschewed, and but half of the weight of solid and liquid nutriment required by a normal person is permitted.

Ebstein's régime is a modified "Banting" which permits more fat and less proteid food.

Van Noorden's régime allows a number of small meals, and permits starches rather than fats.

Oertel's régime limits the consumption of

fluid, and restricts the consumption of fat more than of starch.

Inasmuch, however, as each of the above systems of treatment reduces the bulk of an individual by compelling him to feed upon his own fat and tissues, none of them can be advised as suitable for general adoption. Further, as all methods which restrict, within narrow limits, the ingestion of fluids put an increased strain upon the kidneys to rid the system of waste, none but otherwise healthy obese individuals should submit to any rigorous species of "Banting" unless under skilled observation.

The following is an example of a sufficiently strict régime :—

Breakfast—

Lean meat	3 ozs.
Bread	1 oz.

A cup of coffee or tea with no milk, and saxin instead of sugar.

Dinner—

Cup of clear soup	
White fish	2 ozs.
White meat	2 ozs.
Green vegetables	
Baked apple or an orange	

Afternoon tea—

Cup of milk and a thick cracker.

Supper—

Lean meat	3 ozs.
Toasted bread	2 ozs.

At bed time—

Glass of milk and a hard cracker.

A little water may also be allowed to quench thirst in addition to the above régime.

The rationale of every sound form of treatment should be to withhold starches, sugars, fats and fluids in so far as is possible and compatible with the enjoyment of good health.

Leanness.

When this condition is due to neither heredity nor disease it may often be antagonised and relieved by attending to the dietetic rules given, and partaking of as rich a diet of starches, sugars and fats as will digest well. Moderate muscular exercise only should be indulged in, and a fair amount of fluid should be taken. For general guidance it might be borne in mind that the state of leanness is the opposite to that of obesity, and that to reverse the directions given for the treatment of the latter condition may logically be the correct one for the former. There is one factor, however, which must be taken into consideration before adopting this plan, and that is to give due weight to the

influence of the mind upon the body in causing both conditions. "Laugh and grow fat" has become an everyday adage, and "Worry and grow thin" would be quite if not a more philosophical quotation to express the intimate connection which exists between the ponderable and imponderable part of man.

Constipation.

Constipation is one of the commonest causes of the ailment which affect people, for it not only prevents the proper digestion of food, but by giving rise to blood poisoning it also disturbs the functional activity of every organ in the body. The following measures may be generally relied on to afford relief:—

1. Partake of a diet largely composed of wholemeal or stale bread, bulky non-starchy vegetables, fruit, butter, fat, oil, and preserves.
2. Ingest at least 3 pints of fluid every day—half a pint of which in the form of hot water may be usually with advantage sipped slowly night and morning.
3. Drink sparingly of tea, coffee, and milk; and never take them with meat. Alcohol is contraindicated, and sherry and all red wines are "binding."
4. *Avoid* new bread, pastry, hard-boiled eggs, and such starchy foods as: Rice, tapioca, sago, peas, beans, and new potatoes.
5. Live a hygienic life:—Clothe warmly; take sufficient exercise; sponge each morning with cold or tepid water, and dry with a rough towel; and, retire at a regular hour every morning to relieve the bowels.

CHAPTER XI.

WATER.

Water is one of the triad—Food, Air and Water—upon which life depends, and the influence of its quality and quantity on health is incalculable.

Deprived of water a human being succumbs in one third of the time, than if deprived of food only.

Water covers three-fourths the surface of the earth, and constitutes two-thirds by weight of the bodies of animals, and nine-tenths by weight of the structures of plants.

The air and soil contain water: and were it not for the moisture contained in the atmosphere, everything on the surface of the earth would be burnt up by the direct heat rays of the sun by day, and frozen to destruction by night; and, were it not for the water contained

in the soil, vegetable life would cease, and man could not exist.

The blood which carries nourishment to the tissues and removes waste, and all the secretions and excretions of the body are mainly composed of water.

An insufficient supply of water makes hygiene impossible, and leads to public, personal, and domestic uncleanliness, atmospheric contamination and disease.

Sources.

All water is originally derived from rain, which is the condensed aqueous vapour, distilled from the surface of the Earth and Sea, by the heat of the sun's rays.

Since life first began on our planet, a continuous never ceasing circulation of water from sea and earth to sky, and from sky to earth and sea, has been in progress, and is an illustration of the theory of the "Conservation of energy," which asserts that "*nothing is ever lost in nature*" or that "Matter is Indestructible."

When rain falls, part of it is evaporated again; part flows along the surface of the soil to form brooks, creeks, lakes, rivers; and, part sinks

into the ground, either to form underground lakes, or wells, or to come to the surface again as springs.

The amount of water derived from rain is infinitely greater than generally supposed; for one inch of rain on a square yard is equivalent to over four and a half gallons, and one inch on a square mile to fourteen and a half million gallons; and though the average rainfall for all England is but about twenty-five inches per annum, an inch of rain has been known often to fall in a single day.

In mountainous regions, with steep inclines, much of the downfall runs off in streams; and in all regions the amount of rain which percolates through the soil depends upon the nature and configuration of the earth upon which it falls.

Thus, through a loose porous gravel soil, ninety per cent. may sink, whereas through chalk, only forty per cent., and through sodden clay scarcely any percolates.

Rain in its passage through the air washes it, and becomes charged and carries down with it carbonic acid gas, microbes, deleterious bodies, and dust of every kind; and as it percolates

the soil it absorbs still more carbonic acid (which is always present, and is derived from the action of microbes breaking down putrid substances etc). Being thus highly charged with acid it dissolves the potash, soda, lime, magnesia, silicon, iron and other minerals which constitute the earth's crust. Some of the now highly mineralised rain water is utilised as the vital fluid necessary for the growth and development of plant life (and when it has served this purpose is evaporated from their leaves), whilst the remainder by further filtration through the earth is freed, more or less, from organic matter, and is the source of our water supply, etc.

Wells and Springs.

A SHALLOW WELL is one which is less than fifty feet in depth, and is formed by the rain which percolates through the soil being arrested by a solid compact formation of the earth.

A DEEP WELL is formed when rain percolates through a fissure in a compact formation at a greater depth than fifty feet.

A SPRING is formed when the bed upon which

a deep well rests, slopes gradually up to the surface of the land again at some distance off.

Purity.

RAIN WATER, except collected (in clean utensils free from lead which it dissolves), away from towns, is unsafe to use for drinking purposes.

In the country and in mountainous districts, away from habitations, it is very pure and wholesome, and being very *soft*, makes a good lather with soap, and is admirable and economical for laundry work.

Deep well water is as a rule wholesome, bright, clear, and sparkling, but it is frequently very *hard*, as it usually contains much chalk and other minerals.

It may be *softened*, however, by boiling, as this drives off the carbonic acid which keeps the lime (which doesn't form a lather with soap) dissolved in it. The addition of an ounce of quicklime to each hundred gallons of hard water effects the same purpose, for in both instances carbonate of lime and solid mineral substances sink to the bottom.

Shallow Wells.—The waters from shallow wells, in proximity to middens, stables, cow-sheds, and pig-styes, etc., are, mostly, very contaminated and dangerous to ingest, for the rain washes all kinds of filth into wells thus situated.

Shallow well water contaminated by animal excretions is generally *hard* and unsuitable for washing or for laundry purposes.

A shallow well drains the ground round it for a distance equivalent to four times its depth. Thus a well forty-five feet deep drains and absorbs the impurities from a distance of sixty yards in every direction and if contaminated by the excretions of animals or human beings will be dangerous to drink, and HARD ALSO to wash with.

River water is of variable purity, as much depends upon whether or not sewage contamination gains access to it from the adjoining lands and tanks.

If the stream be rapid and the river long, impurities become deposited at the bottom as sludge, and rendered harmless by the chemical action of aquatic animals and plants.

In England, however, river water is generally unsafe to drink, unless filtered and cleansed from impurity, for NONE OF OUR rivers are long and rapid enough to purify their waters effectually, at all times. River water is usually *soft* and useful for laundry and washing purposes.

Lake water being stagnant is of very uncertain composition and purity. The waters of lakes away from habitations are, however, usually very pure, and as a matter of fact furnish some of the largest towns in the United Kingdom with unsurpassable supplies. Lake water is also as a rule very *soft*.

Spring waters partake of the nature of the deep wells from which they originate, and are of like purity and quality if their sites be uncontaminated.

UPLAND SURFACE WATER.—Rain which has collected on the surface of mountain tops is, as a rule, excellent in all respects.

Characters of Good Water.

Good water is free from colour, smell and taste, and is not excessively hard.

It is impossible, however, definitely to decide whether water is usable or not, unless it has been analysed.

Geological Characters.

The suitability of water for general purposes depends also upon its geological source.

Granite, *slate*, trap-rock, and mill-stone grit formation waters are usually very pure and contain a small amount of solids only.

Soft sand rock and loose sand waters are frequently impure and contain vegetable and animal matter.

Chalk waters are usually pure, palatable, and sparkling, but being *temporarily* hard require boiling for laundry purposes.

Limestone and magnesian limestone waters are also pure, but possess *permanent* hardness which is not removable by boiling.

Clay and alluvial waters are generally very impure if their source is near the surface.

Subsoil, *marsh water*, and water which has

drained through graveyards, is usually highly contaminated; and water from wells near the sea are often impregnated with salt.

Purification.

Purification of water is conducted on a large scale by companies and it is only needful to consider the domestic precautions to secure a pure supply.

Cisterns should never be made of lead, should be kept covered and ventilated, and be frequently run off and cleaned out, to prevent dust and dirt from contaminating an otherwise pure supply of water.

Cisterns which supply W.C.'s ought never to be used to draw drinking water from.

A pipe with a screw-down tap should always be led direct from the house main, to supply water for cooking and drinking purposes.

This is an important matter to attend to, for, even to-day, in London, many of the most recently built modern houses, with otherwise excellent water supplies, are deficient in this respect.

Filters.

Domestic filters are mostly not only useless but harmful. Sponge filters are an abomina-

tion in the apertures of which microbes of disease lurk, and filth abounds; and, by them good water is made bad, and bad water worse. The same remarks to a great measure extend to charcoal block filters.

The best domestic filters are those of spongy iron, magnetic carbide of iron and carferal; and porcelain filters which remove microbes from water are also most excellent.

A good domestic filter should be of simple construction, and easy to take to pieces to clean; and it should not contain any material which might contaminate the water passing through it.

To make one, cover the aperture of an ordinary earthen flower pot with a piece of clean well washed flannel; superimpose upon this, three-inch layers of clean gravel, white sand, and animal charcoal, and top with a thin layer of coarse gravel.

To cleanse. Heat the layers at frequent intervals in an iron frying-pan, or replace them by fresh material.

The readiest safeguard to adopt if water be impure is to boil it thoroughly for thirty minutes to kill any microbes it may contain,

and to subsequently be made more palatable by filtering it, or pouring it through a sieve from some height.

Precautions.

Water absorbs impurities and foul gases very rapidly if allowed to stand in dwelling rooms, and soon becomes putrid. It is therefore important to be certain that dwellings *are* well ventilated and free from sewer gas, as otherwise cisterns and pipes are very likely to be fouled and the water they contain contaminated.

Amount required.

It is estimated that 30 gallons per head per day are required to maintain the good health of a community, viz.

Domestic Supply	12 gallons
Bath	4 ,,
W.C.'s	6 ,,
Waste	3 ,,
Factories	5 ,,

Personal Requirements.

To keep the blood, secretions, excretions, and tissues of the body in a healthy condition, an adult requires for nutrition about four pints of water daily (one pint in food, and three pints in

liquid) to balance that which is given off from the body in the following ways—

Skin	24 ozs.	
Kidneys	$36\frac{4}{5}$,,	
Lungs	16 ,,	
Intestines	$3\frac{1}{5}$,,	= 80 ozs. or 4 pints.

Domestic Requirements.

For domestic use 12 gallons per head is needed. This includes for :—

	galls.	quarts.
Cooking	0	$2\frac{1}{2}$
Drinking etc.	0	$1\frac{1}{2}$
Personal ablutions	5	0
House and Laundry	6	0

The Effects of Water upon Health.

Excess of Water.—Though pure water is essential to good health the ingestion of too much water is ofttimes harmful, for it either leads to an excessive action of the skin or kidneys, or to a water-logged obese condition of the tissues.

Drinking an excessive quantity of fluid with meals dilutes the gastric juice, retards

digestion and causes indigestion ; and imbibing large draughts of water, when overheated, often gives rise to colic, or even inflammation of the bowels and *appendicitis.*

Except in the case of children, however, it must be admitted that *very little harm results from water drinking;* and, as a matter of fact adults, as a rule, take much too small a quantity of it.

An insufficiency of water leads to a restricted action of the skin and lessened perspiration, and to the retention of heat in the body. It also interferes with the discharge by the skin, kidneys, and intestines, of the impure waste products from the body, which cause, when not eliminated, an impoverished condition of the blood, indigestion, gout, constipation and many other ailments.

Apart from the effects of ingesting too little water upon the body, an inadequate supply leads also, as stated, to municipal, domestic, and personal uncleanliness. The air becomes contaminated, sewers and drains get choked, and animal and vegetable waste (not being washed away) putrefies; and these factors predispose to, and cause disease to become rife.

Cooking too is imperfectly accomplished, and the food thus prepared is very liable to cause illness.

A general lowered state of health of the population usually coincides with scarcity of water in a district; and a marked predisposition exists to skin affections, ophthalmia, typhus fever, typhoid fever, and diarrhœa; and, indeed, to all diseases attributable to defective sanitation.

Impure Water.

Impure water is a common source of disease, whether the contamination be of animal, vegetable or mineral nature.

Animal contamination is the most serious, as it is the chief means by which many infectious, and all water-borne diseases, are spread and become epidemic.

Vegetable impurities, such as those contained in moorland and peaty waters, are much less harmful; but they often cause diarrhœa, and they may give rise to *lead poisoning*, owing to their plumbo solvent action on leaden pipes and cisterns, in consequence of their containing a vegetable acid which dissolves lead, and of

their *not* containing enough lime and other minerals to coat and protect the pipes from the action of this acid.

Minerals—All waters contain minerals, which, unless present in excess or of a poisonous nature, are quite harmless.

Lime, magnesia, or iron, in excess, often causes dyspepsia and diarrhœa; and, as the *hardness of water* is due to its mineral constituents, such waters may be unsuitable for laundry purposes.

Lead, copper, mercury, arsenic, and zinc poisoning may occur from drinking waters to which these minerals have gained access, either from storage vessels or otherwise, but these occurrences are not very frequent. Though but a few weeks since, indeed, the defective insulation of an electric supply main acting upon a leaden water pipe was stated to have been the source of an epidemic of lead poisoning.

Conclusions.

For domestic purposes nothing short of *distillation or boiling* will ensure a supply of

water contaminated by the germs of disease, being rendered harmless and safe to drink or ingest.

Distilling is the most effective means of removing every source of danger—animal, mineral and microbic—but it unfortunately drives off the oxygen and renders water insipid and flat. There are, however, many inexpensive stills now sold which in a measure obviate this defect.

Boiling destroys most of the organisms of disease that water may contain, causes a deposition of minerals on standing, and, in the absence of a *still*, is the next safest method to adopt for purification. Boiled water is also, however, flat, but pouring it through a fine sieve from a height improves its taste, by recharging it with oxygen from the air.

Filters have already been considered, but even the most effectual domestic ones cannot be relied upon to purify water perfectly in times of epidemic, unless the suspected water has been previously boiled.

APPENDIX.

Section 1.—Invalid Diet Formulæ.

As some uncertainty still prevails, notwithstanding the many excellent books on Cookery which are in circulation, when the question arises of how to prepare nourishment for an invalid, I here give a few recipes suitable for very urgent cases of illness.

I would, however, again point out that unless milk or eggs form the basis of a diet for a person who is ill and cannot take solids, very little nourishment can be afforded by the small quantities of farinaceous substances indicated; and that *beef teas*, *extracts*, and *essences of meat* of every kind can only be regarded as stimulating appetisers or "stop gaps," and should, if possible, only be used, and viewed, as *accessory articles* of diet. I am constrained to impress these facts more strongly than may at first sight appear justifiable, because I have so often witnessed invalids starved by nurses who considered meat preparations of this class much more valuable and nourishing than milk; therefore, as soon as an individual can take milk with safety, he should not be debarred

from doing so, for, as pointed out in a previous part of this little work, milk can nearly always by some care be adapted to suit every person.

Whether milk be made into blanc-mange or mixed with eggs to form custard puddings, or given with rice, or flavoured, or used in any other way, is quite immaterial, as long as the patient will and can take it, for it is by far the most valuable and important product of nature we have to rely on, wherewith to sustain the vital energies in sickness.

Eggs whipped raw, lightly boiled, or mixed in any way, when ingested are though not as generally useful or acceptable to patients, not second to milk in nutritive qualites, and for this reason are of invaluable service for sustaining the body and restoring its vigour.

In preparing and serving an invalid's food it should always be the object of the attendant to do so as tastefully and carefully as possible.

Enough is better than a feast, and just that quantity which can be consumed with relish and advantage, should be nicely served and given as required only.

To stimulate the appetite cleanliness is essential, and the hands of the nurse, the tray,

serviette, and utensil containing the nutriment, should be free from any suspicions of want of care in this respect. Invalids are usually hypersensitive, and unless these facts be well borne in mind their tastes may easily be offended, and an aversion to food may result, which will be all but impossible to combat.

Arrowroot.

Mix two teaspoonfuls of arrowroot into a smooth paste with a tablespoonful of cold water, and stir it well into a pint of boiling milk gradually poured on.

Sweeten with sugar, and flavour if desired with nutmeg, cinnamon, lemon peel or vanilla.

Some prefer to boil for a minute or so, but it is not necessary.

Barley Gruel.

Wash four tablespoonfuls of Scotch pearl barley with cold water, and boil it for a quarter of an hour in about half a pint of fresh water; then strain and boil it again in two pints of water until reduced to half that quantity by evaporation. Strain again for use and sweeten to taste.

Barley Water.

Proceed as on previous page, but instead of adding two pints of boiling water, add two quarts and reduce as before to one half, etc.

These preparations are more easily and rapidly made with prepared barley flour, full directions respecting which are to be found on the packets containing it.

Barley Milk Gruel.

Mix a tablespoonful of prepared barley flour into a paste with cold water, to which add half a pint of boiling milk, place in a saucepan and simmer for ten minutes, stirring well all the time. Sweeten to taste.

Beef Tea.

Mince or cut into small pieces 1 lb. of lean gravy beef, free from skin and fat, and place it in a saucepan with one quart of cold water. Put on a fire, and, when boiling, add an eggspoonful of salt to it. Skim well and then allow it to simmer quietly for half an hour, keeping it well skimmed if necessary all the time.

The beef tea may now be strained through a sieve and allowed to cool, and if the fat be then

removed, it is ready for use, as required, by heating small portions of it up again.

Placing the beef, salt, and water in a baking jar, covering securely and standing it in a warm oven for three or four hours will serve the same purpose.

Chicken Broth.

This contains *more proteid* than beef broth, and is *not always so easily digested.* It may be made in the same way as beef tea, but as it is usually preferred flavoured with mace or sweet herbs it is scarcely as suitable for very urgent cases of illness.

Essence of Beef.

Pound and mix in a mortar one pound of minced gravy beef (free from skin and fat) with two tablespoonfuls of water and a pinch of salt.

Place it in a securely covered air-tight earthen jar (the edges of the lid may be cemented with pudding paste to effect this) in an oven, or pot of boiling water, for three hours, strain through a coarse sieve, give in two teaspoonful doses, frequently.

This is an expensive preparation, for not

more than about four tablespoonfuls of *essence* can be recovered.

It is, however, of use in conditions of great exhaustion from any cause.

Extract of Beef.

Mix a pound of minced rump steak with a pint of cold water and a saltspoonful of salt. Heat it slowly by the side of the fire for a couple of hours before it simmers and then boil gently for fifteen minutes, strain, skim, and serve.

The addition of some cream, or of arrowroot, prepared barley, or any other farinaceous powder to this beef tea, will increase its nourishing property; and if the patient does not object to a little fat, it is all the better not to be over particular in skimming it.

Beef, Mutton, or Veal Broth.

Take one pound and a half of mutton, beef, or veal, one quart of cold water, a little salt, and two ounces of rice. Simmer for four hours, then boil for a few minutes and strain.

Restorative Raw Meat Juice.

To a pound of finely minced beef, free from fat etc., add half a teaspoonful of salt, fifteen

drops of dilute hydrochloric acid, and half a pint of water (distilled is best), allow it to stand for three hours and strain for use.

This may be taken in wineglassful doses by an adult, at frequent intervals, but it must only be heated by standing a bottle containing it in hot water.

This is an excellent stimulant in wasting and debilitating diseases, and in many conditions of great exhaustion.

In cases of bloodlessness, *scurvy, and rickets*, it is a most valuable addition to an infant's diet, and may be mixed with milk, but in that case it is better not to use the acid in its preparation.

A teaspoonful of raw meat finely chopped or pounded in a mortar with a little Demerara sugar, spread on bread, is frequently relished by rickety and debilitated children, and may be often given with advantage, but as *intestinal worms* may be conveyed to children in this way, well strained raw beef juice is preferable.

Eggs, Cream and Extract of Beef.

Wash thoroughly 2 ozs. of pearl sago, and stew it in a half pint of water until it is tender

and very thick; mix with a half pint of boiling cream, and the yolks of four new-laid eggs, and then add to this carefully one quart of good beef tea.

There is really some nourishment in the above preparation, and it is one of the most useful of broths for those convalescent from lingering illnesses, if taken in wineglassful doses as required and digested.

Egg Drink.

Boil half a pint of milk sweetened with sugar, and, when boiling, pour it over and incorporate it well with the white of an egg which has been beaten to a stiff froth.

This preparation is one which is most useful in many conditions of ill-health.

Lime Water and Milk.

Is simply made by the addition of one part of lime water to two of milk.

Milk and Soda Water.

This is sometimes retained on the stomach when all else is rejected, by reason of the sedative effect of the carbonic acid gas contained in the soda water. It should always be

remembered, however, to add the soda water to the milk, and not vice versâ, as I have often seen done unless the patient suffers from flatulence.

Milk and Bicarbonate of Soda.

The addition of 15 grains of bicarbonate of soda to a quart of milk is often useful, for it prevents it turning sour so soon, and renders it more digestible.

Bread Jelly.

Cover the soft part of a loaf with boiling water and allow it to soak for some hours; strain and add fresh water, and allow the mixture to boil until it becomes soft and smooth; press the water out and the bread will form a thick jelly on cooling. This may be mixed with milk as required.

This is a useful addition to make to an infant's milk, at about the period of weaning.

Nutritious Demulcent Drink.

A tumblerful of milk boiled with a good pinch of isinglass and sweetened with sugar.

In cases of sore throat or irritation of the stomach and diarrhœa this is an admirable food.

Iceland and Carragheen Moss.

Boil an ounce each of Iceland and Carragheen moss for three quarters of an hour in a pint and a half of milk, strain through muslin, and add a couple of lumps of sugar.

This preparation is a very nutritious one, and was formerly held in high esteem in cases of consumption.

Milk Peptonized.

To a pint of milk add a quarter of a pint of water, allow this to stand, and skim the cream off it. Now bring the mixture to 140° F. and having added twenty grains of bicarbonate of soda, and two teaspoonfuls of zymine, allow it to stand by the fire for an hour and a half. Boil then for three minutes to stop fermentation; allow to cool, and replace the cream removed. Keep for use on ice.

Milk thus prepared is particularly easy to digest and may be given in all conditions, during every period of life, which are characterised by defective digestion and debility.

Milk may also be fairly well peptonized in the same way as above, without heating, if placed immediately on ice. For rectal

feeding peptonizing is indicated, though not essential.

N.B.—Beef, veal or chicken broths may be peptonized in the same way as directed for milk, and are stimulating, appetising and digestible, though of little real nutritive value.

Milk and Suet.

Tie an ounce of finely chopped suet in a muslin bag, and boil it slowly in a quart of milk; sweeten with sugar.

In the absence of cream this is an excellent way to enrich milk, and is of great service in wasting diseases, and in cases of consumption, if it can be digested.

Whey.

To a pint of milk add one teaspoonful of rennet. Let this mixture stand in a warm place until the curd forms and the whey is clear. When cool break up the curd and strain off the whey through a piece of muslin.

Whey is an excellent modified form of milk to give when the digestive functions are imperfect and milk otherwise treated cannot be retained; and, indeed, a "Whey cure" is advocated by some in cases of dyspepsia and in plethoric conditions.

But inasmuch as, in the process of being converted into whey, milk is deprived of its proteids and fat, the quantity of whey given has to be gradually increased until about 5 pints a day are ingested in addition to vegetables and fruits. In infantile disturbances and other critical states, whey alone, if given for a few days with perhaps the addition of some cream, is often of great service; and in the treatment of TYPHOID fever is also very often of inestimable value.

WHEY (LEMON).

Boil half a pint of milk and a tablespoonful of sugar together. When boiled add one tablespoonful of lemon juice and boil again. Allow the mixture then to stand and treat as in last instance.

Whey made in this way is useful when rennet cannot be obtained, and it can be used in the same manner and for the same conditions as if made with rennet. Perhaps for cases of Scurvy, occurring in children, it is even more suitable.

TOAST WATER.

Toast the crust of a stale loaf brown, place it in a jug, and pour a quart of boiling water over it; strain for use when cool.

Lemonade.

Squeeze the juice of a good sized lemon into a jug, to which add a quart of cold or hot water, a small piece of lemon peel, and sugar to taste.

When this preparation is made by pouring boiling water upon slices of lemon, even if they be as free from rind and pith as possible, it is not nearly so palatable and is often very bitter.

Section II.

The following classic table was compiled by Dr. Beaumont, as the result of the investigations made by him on a man who had met with a gunshot injury which penetrated his stomach and never healed.

III.—Relative digestibility of foods :—

	Preparation.	H.	M.
Rice,	Boiled,	1	0
Pig's feet, soused,	,,	1	0
Tripe, soused,	,,	1	0
Trout, salmon, fresh,	,,	1	30
,, ,, ,,	fried,	1	30
Eggs, whipped,	raw,	1	30
Soup, barley,	boiled,	1	30
Apples, sweet, mellow,	raw,	1	30
Venison steak,	broiled,	1	35
Brains, animals,	boiled,	1	45
Sago,	,,	1	45
Tapioca,	,,	2	0
Barley,	,,	2	0
Milk,	,,	2	0
Liver, beefs, fresh,	broiled,	2	0
Eggs, fresh,	raw,	2	0
Codfish, cured, dry,	boiled,	2	0
Apples, sour, mellow,	raw,	2	0
Cabbage, with vinegar,	,,	2	0
Milk,	,,	2	15
Eggs, fresh,	roasted,	2	15
Turkey, wild,	,,	2	18
,, domestic,	boiled,	2	25
Gelatine,	,,	2	30

	Preparation.	H.	M.
Turkey, domestic,	Roasted,	2	30
Goose, wild,	"	2	30
Pig, suckling,	"	2	30
Lamb, fresh,	broiled,	2	30
Hashed, meat and vegetables,	warmed,	2	30
Beans, pods,	boiled,	2	30
Cake, sponge,	baked,	2	30
Parsnips,	boiled,	2	30
Potatoes, Irish,	roasted,	2	30
" "	baked,	2	30
Cabbage, head,	raw,	2	30
Spinal marrow, animal,	boiled,	2	40
Chicken, full-grown,	fricasséd,	2	45
Custard,	baked,	2	45
Beef, with salt only,	boiled,	2	45
Apples, sour, hard,	raw,	2	50
Oysters, fresh,	"	2	55
Eggs, fresh,	soft boiled,	3	0
Bass, striped, fresh,	broiled,	3	0
Beef, fresh, lean, rare,	roasted,	3	0
Beefsteak,	broiled	3	0
Pork, recently salted,	raw,	3	0
" " "	stewed,	3	0
Mutton, fresh,	broiled,	3	0
" "	boiled,	3	0
Soup, bean,	"	3	0
Chicken soup,	"	3	0
Aponeurosis,	"	3	0
Dumpling, apple,	"	3	0
Cake, corn,	baked,	3	0
Oysters, fresh,	roasted,	3	15
Pork, recently salted,	broiled,	3	15
Pork, steak,	"	3	15
Mutton, fresh,	roasted,	3	15
Bread, corn,	baked,	3	15
Carrot, orange,	boiled,	3	15
Sausage, fresh,	broiled,	3	20

	Preparation.	H.	M.
Flounder, fresh,	Eried,	3	30
Catfish, fresh,	,,	3	30
Oysters, fresh,	stewed,	3	30
Beef, fresh, lean and dry,	roasted,	3	30
Beef, with mustard, etc.,	boiled,	3	30
Butter,	melted,	3	30
Cheese, old, strong,	raw,	3	30
Soup, mutton.	boiled,	3	30
Oyster soup,	,,	3	30
Bread, wheat, fresh,	baked,	3	30
Turnips, flat,	boiled,	3	30
Potatoes, Irish,	,,	3	30
Eggs, fresh,	hard boiled,	3	30
,, ,,	fried,	3	30
Green corn and beans,	boiled,	3	40
Beets,	,,	3	45
Salmon, salted,	,,	4	0
Beef,	fried,	4	0
Veal, fresh,	boiled,	4	0
Fowls, domestic,	,,	4	0
,, ,,	roasted,	4	0
Ducks, ,,	,,	4	0
Soup, beef, vegetables and bread,	boiled,	4	0
Heart, animal,	fried,	4	0
Beef, old salted,	boiled,	4	15
Pork, recently salted,	fried,	4	15
Soup, marrow bone,	boiled,	4	15
Cartilage,	,,	4	15
Pork, recently salted,	,,	4	30
Veal, fresh,	fried,	4	30
Ducks, wild,	roasted,	4	30
Suet, mutton,	boiled,	4	30
Cabbage,	,,	4	30
Pork, fat and lean,	roasted,	5	15
Tendon,	boiled,	5	30
Suet, beef, fresh,	,,	5	30

SACCO, THE FASTING MAN.

As a cogent illustration of my conclusions, and to substantiate further that which I have written respecting the influence of either starvation or an insufficiency of food and water on the human organism, I would cite the recent feat of Guiseppe Sacco, who is alleged to have fasted 45 days and to have lost during that period 55 lbs. or 27 per cent. in weight. I visited this man on the thirtieth day, of his self-imposed ordeal, and was informed that his temperature was 95° F. (3·4 less than normal due to want of fuel or food—page 63) his pulse 79, (above normal, the result of heart weakness) his respirations 22, (above normal, in keeping with the pulsations of his heart, and the necessity of fanning the vital flame—page 61) his weight 125 lbs., and that he had lost on the average 1 lb. 7 oz. per day (by referring to page 76, it will be seen that this is all but the loss which the daily ingestion of 15 ozs. of solid dry food, or 30 ozs. of cooked would have prevented) since the beginning of his fast.

Though Sacco lost 12 ozs. less in weight daily than the amount stated by me to ensue (page 69) in the case of a man starving to death, yet, I believe this discrepancy might be explained by the fact that he was *well clad* and protected from all *external cooling* influences—by being confined in a warm room heated by an electric radiator—and practically *neither worked nor took exercise.*

Sacco also smoked much (which may have had some influence in lessening his bodily waste) and partook freely of mineral water to compensate for the loss of fluid from his body (4 lbs. a day, page 69.)

DIET TABLE.
LONDON HOSPITAL.

Diets to which NO EXTRAS may be added.

[*Vide Regulation I.*]

Not requiring to be re-ordered on Diet Day.

BREAD AND MILK DIET—Milk, 4 pints (D).
„ 3 pints (C).
Bread, 6 ozs.
Pudding.
For Supper—Cocoa or Porridge or Gruel.

DIET No. 1. (A)—Bread, 8 ozs.
Potatoes, 8 ozs.
Fried Fish (or boiled if specially ordered), 10 oz.
Milk, 1 pint.
Pudding.
(Green Vegetables at Discretion).
For Supper—Soup, or ½ pint Milk or Cocoa, or Porridge or Gruel.
(B)—As (A), but with an extra pint of Milk or 1 Egg.

DIET No. 2. (A)—Bread, 10 ozs.
Potatoes, 8 ozs.
Meat, 4 ozs.
Milk, 1 pint.
Pudding.
Green Vegetables.
For Supper—Soup, or ½ pint Milk or Cocoa, or Porridge or Gruel.
(B)—As (A), but with an extra pint of Milk or 1 Egg.

DIET No. 3. Bread, 12 ozs.
Potatoes, 8 ozs.
Meat, 6 ozs.
Milk, 1 pint.
Pudding.
Green Vegetables.
For Supper—Soup, or ½ pint Milk or Cocoa, or Porridge or Gruel.

CHILDREN'S DIET—Bread, 7 ozs.
Potatoes, 6 ozs.
Meat, 2 ozs., or Fish, 5 ozs.
(A) Milk, 1 pint; or (B) 2 pints.
Pudding.
Vegetables three times a week.

Must be re-ordered on Diet Day.

DIET No. 4.—(Suitable for Convalescents).
Bread, 10 ozs.
Potatoes, 8 ozs.
Meat, 4 ozs., or Fish, 10 ozs.
Bacon, 4 ozs. (cooked).
Milk, 2 pints.
Pudding.
Green Vegetables.
For Supper—Cocoa, or Porridge or Gruel.
For Hebrews only—2 Eggs in lieu of Bacon.

Diets 1, 2, 3 and 4.—If Beer be ordered, such an order carries with it a corresponding reduction of Milk.

Diets to which
EXTRAS may be added.

FOUNDATION DIET	(A)—1 Egg.	
	Milk, 1 pint.	
	Bread, 6 ozs.	
	(B)—Milk, 2 pints.	
	Bread, 6 ozs.	
MILK DIET	Milk, 2 pints (B).	
	" 3 pints (C).	
	" 4 pints (D).	

All extras to be divided into :—

Group A.—Requiring to be re-ordered once a week (on Wednesday).

Beef Tea and Mutton Broth.
Eggs.
Milk.
Cooked Beef and Mutton, 4 and 6 ozs.
Fish.
Chicken.
Rabbit.
Bacon.
Patent Foods and Meat Extracts.
Beef Steak, Chop and Mince (minced raw and sent to Ward).
Porter, Ale and Stout.
Wines and Spirits.
Cream.
Fruit.

Group B.—Not requiring to be renewed weekly.

Potatoes.
Greens.
Pudding.
Soup.
Bread.
Rusks.
Water Cress.
Lemonade.
Coffee.
Cocoa.
Gruel.
Porridge.
Arrowroot.

Regulations for the use of these Diets.

1.—Extras, other than Beer, Wine, Spirits and Aërated Beverages, may not be added to any of the Diets in the left-hand page. (Bread and Milk Diet, Diets 1, 2, 3 and 4, and Children's Diet).

2.—On the other hand, extras may be added to Foundation or to Milk Diet. These Diets would therefore form the Foundation upon which the Physician would prescribe a Diet for a Patient who is severely ill, and who cannot be placed upon one of the Diets in the left-hand page.

3.—Each Ward shall have a "Diet Day" once a week, upon which all extras belonging to Group A will lapse, unless they are re-ordered individually upon the Prescription Sheet.

The Hospital does not provide Tea, Sugar, or Butter for Patients. The poorer patients are provided with these articles of Diet by the "Marie Celeste" Samaritan Society.

APRIL, 1905. BY ORDER.

DIET TABLES

(Adjusted for Children of 7 years)

The Hospital for Sick Children Gt. Ormond St. London.

Milk Diet.

Breakfast 8 a.m.	Milk ½ pint, Bread 2 ounces with butter.
Dinner (noon)	Rice or other milk pudding. Milk ⅓, or Beef tea ½ a pint.
Tea 4 p.m.	Milk ½ pint, Bread 2 ounces with butter.
Supper 6 p.m. or set aside for night or early morning	Milk ½ pint, Bread 2 ounces with butter.

N.B.—In all the equivalent of above, 2 pints of milk—6 ozs. of bread—and some butter and rice.—Author.

Fish Diet.

Breakfast	Milk or cocoa with sugar ½ pint, Bread 2½ ounces with butter.
Dinner	Fish 2½ ounces, mashed potatoes 3 ounces. Rice or other milk pudding.
Tea	Bread 2½ ounces with dripping, butter or treacle. Milk ⅓ pint.
Supper	Bread 2 ounces with butter or dripping and Milk ⅓ pint.

Meat Diet.

Breakfast	Milk or cocoa with sugar ½ pint. Bread 2½ ounces with butter.
Dinner	Roast or boiled mutton or roast beef 2½ ounces. Mashed potatoes 4 ounces. Rice or other milk pudding.

Tea	Bread $2\frac{1}{2}$ ounces with dripping, butter or treacle. Milk $\frac{1}{3}$ pint.
Supper	Bread 2 ounces with butter or dripping. Milk $\frac{1}{3}$ pint.

The above diet consists of $1\frac{1}{6}$ pints of milk, and about 21 ozs. of solid food, composed of approximately :—

Carbohydrates	16	ozs.
Fats	2	,,
Proteids	$2\frac{1}{2}$	,,
Salts	$\frac{1}{2}$	,,

Two Standard Diets.

Suitable for healthy adult men of average weight and build engaged in moderate daily work.

	lbs.	ozs.	lbs.	ozs.
Bread,	1	0	0	9
Meat,	0	8	0	8
Fish,	0	0	0	4
Potatoes,	1	0	0	8
Eggs (2),	0	1	0	1
Cheese,	0	2	0	1
Butter or fat,	0	4	0	1
Milk $\frac{1}{2}$ pint,	0	$\frac{3}{10}$ths	0	$\frac{3}{10}$ths
Rice,	0	0	0	2
Sugar,	0	0	0	$1\frac{1}{2}$
Total weight of solids,	2	$15\frac{3}{10}$	2	$3\frac{4}{5}$

Section III.

GLOSSARY.

THE following words are capable of other definitions. The meanings given are, however, those most applicable to the sense and construction of the text.

ABDOMINAL, relating to the abdomen.

ABSORB, to suck in.

ACID, a sour substance which combines with metals, etc. to form salts, and turns blue vegetable colours, red.

AD-INFINITUM, to infinity; without end.

AFFINITY, the force by which elements are held together.

ALBUMIN, a proteid substance containing nitrogen; white of egg.

ALCHEMIST, an individual skilled in alchemy or primitive chemistry.

ALIMENTARY CANAL, the digestive canal which extends from the mouth to the outlet of the lower bowel or body.

ALKALI, a substance which neutralises an acid and forms a salt with it, etc.

ALLUVIAL SOIL, soil gained from the sea by the washing up of earth and sand.

ALUMINIUM, a metallic element remarkable for its lightness.

ANÆMIA, a disease characterised by paleness and debility due to impoverished blood.

Analyse, to separate into elementary parts.

Antiseptic, a substance that prevents putrefaction, and diseases due to microbes.

Appendix (vermiformis), a tube with a blind extremity attached to the commencement of the large intestine.

Argon, an element recently discovered in the atmosphere, etc.

Assimilate, to convert into a like substance : as flesh meat into flesh.

Atom, a particle of an element.

Atonic, without tone ; debilitated.

Bile, the fluid formed by the cells of the liver.

Bromine, an element closely allied to chlorine in character.

Bronchitis, inflammation of the tubes leading to the air cells of the lungs.

Calcium, a chemical element; see text, lime compounds, etc.

Carbon, a widely diffused element, see text.

Carbonic Acid, an acid formed by the union of one part of carbon with two parts of oxygen.

Carbo-Hydrates, one of the proximate principles of food. Ex. sugar and starches.

Carbon Monoxide, a very poisonous gas formed by the union of one atom of carbon with one atom of oxygen.

Cartilage, a firm elastic animal substance : gristle.

Casein, the nitrogenous principle contained in milk.

Cell, a unit mass of protoplasm or living matter.

Chemical Action. See Index.

Chlorine, a gaseous element greenish in colour and offensive in odour.

CHONDRIN, a nitrogenous substance obtained by boiling cartilage.

COAGULATE, to curdle, precipitate, or clot.

COMBUSTION, consumption by heat (which is due to the combination of the oxygen of the air with other elements.)

COMPLEX SUBSTANCE, a substance composed of more than one element (compound).

CONSERVATION OF MATTER, has reference to the fact that man can neither create nor destroy matter.

CONSUMPTION, Phthisis: A wasting disease due to the ravages of the bacillus tuberculosis.

CONTAMINATE, to poison.

Convulsions, a condition marked by violent involuntary muscular agitation.

CULTIVATE, to grow or reproduce.

DECADENCE, a state of gradual decay.

DELIRIUM, a state of mental excitement.

DESICCATED, dried up; substances from which all water has been removed.

DEVELOP, to gradually grow to a more perfect condition: evolution.

DIABETES, a disease marked especially by a great discharge of sugar in the urine.

DIAPHRAGM, the midriff or muscle which forms the floor of the chest and the roof of the abdominal cavity.

DIASTASE, a vegetable ferment which has the property of converting starch to sugar.

DYSPEPSIA, a term used to signify nearly every form of indigestion.

ELECTRONS, the electric corpuscles or particles of which atoms are composed.

ELEMENT, one of the essential parts of anything.

ENERGY, power of doing work.

EPIGLOTTIS, the elastic structure which covers the glottis or aperture of the trachea or wind-pipe, and prevents food from entering it.

EQUILIBRIUM, equal balancing.

ESSENTIAL, indispensable.

EXCRETE, to separate from.

EXPIRATION, the act of expelling air from the lungs.

FAECES, the excrement discharged from the body by the bowel.

FLUORINE, an element chiefly found in combination with lime.

FIBRIN, a substance containing nitrogen. See index.

FOLLICLE, a tubular-shaped gland. See index.

FUNCTION, the vital activity of any organ, tissue or cell in the discharge of its special office.

GASTRIC, pertaining to the stomach.

GELATIN, a substance containing nitrogen. See Index.

Gland, an organ which manufactures secretions necessary to life, and removes and discharges impurities from the blood.

GLYCOGEN, a substance somewhat similar to starch formed in the liver from sugar.

GULLET, œsophagus or muscular tube which reaches from the throat to the stomach.

HEPATIC, relating to the liver.

HEREDITY, the organic relations between different generations of the same stock.

HYDROGEN, a gaseous element which, combined with oxygen, forms water. See Index.

INDICATE, to point out.

INGEST, to introduce into the stomach.

INOCULATE, to communicate the organism or toxin of a disease, or an organic substance which will prevent or cause a disease, by inserting it into the body through the skin or mucous membrane.

INORGANIC, pertaining to minerals: without life or organisation.

INSOLUBLE, incapable of being dissolved in a fluid.

INSPIRATION, the act of drawing air into the lungs.

INTESTINE, the alimentary canal which leads from the stomach to the outlet of the bowel.

IRON, a metallic element. See Index.

LIFE, animate existence. See Index.

MAGNESIUM, a metallic element which burns brightly and while doing so is changed by oxidation to magnesia.

MASTICATE, to chew or grind up with the teeth.

MEMBRANE, the thin texture which lines the cavities and canals of the body.

METABOLISM, the chemical changes which take place in the body.

MICROBE, bacillus: organism: a microscopic speck of living matter found wherever organic matter is in process of decomposition.

MIDRIFF, see Diaphragm.

MINERAL, an inorganic substance.

MUCUS, a fluid secreted by the mucous membrane.

NITROGEN, a gaseous element forming four-fifths of the atmosphere; a necessary constituent of every organised being. See text.

OBESITY, abnormal fatness. See Index.

ŒSOPHAGUS, see Gullet.

ORGANIC, pertaining to an organ; non-mineral.

ORGANISM, an animal or vegetable being.

OZONE, a condensed form of oxygen.

PANCREAS. See Index for text account.

PASTEURISE, to free by moderate heat from many of the micro-organisms of disease, etc. See Index.

PEPTONE, an albuminoid substance formed by the action of the gastric juices upon proteid substances, see Digestion.

PHARYNX, the muscular tube which forms the space between the mouth, nose, and gullet.

PHOSPHORUS, a yellowish waxy element which emits light in the dark. See Index.

PHYSICAL, pertaining to material things.

PNEUMONIA, inflammation of the cells of the lungs.

POTASSIUM, an element. See Index.

PRIMITIVE, rudimentary; first of its kind.

PRINCIPLE, a settled rule of action; a fundamental truth on which others are founded.

PROTEID, a compound of nitrogen.

PROTOPLASM, a substance chemically allied to albumin (white of egg) which form the physical basis of life. See Index.

PSYCHICAL, pertaining to the mind.

PTOMAIN, see Toxin.

PTYALIN, the ferment of saliva which converts starch to sugar.

PULMONARY, pertaining to the lungs.

RECTUM, the lowermost part of the large intestine.

REPRODUCE, to produce again, or to give birth to; to generate.

RICKETS, a disease mostly confined to children, marked by softness and curvature of the bones. See Index.

RESPIRATORY, pertaining to the act of breathing.

SALIVA, the spittle.

SCURVY, a disease characterised by extravasation of blood under the skin, etc., and debility, due to improper food, and particularly to an insufficiency of vegetable juices.

SEPTIC, putrefactive; a substance that promotes putrefaction.

SILICON, an element which, combined with oxygen, forms silicia. See earth.

SIMPLE BODY, a substance composed of one body. See elements.

SIMULTANEOUS, at the same time; coincident.

SODIUM, a metallic element. See elements.

SOLUBLE, capable of being dissolved in a fluid.

SPECIALISE, to limit to a particular kind of action.

SPONTANEOUS, acting by natural law or by its own influence.

STARCH, the white farinaceous matter of vegetables.

STERILISE, to free from micro-organisms; to purify.

STRATUM, a bed of earth.

SUBJUGATE, to bring under power or to control.

SULPHUR, an element. See elements.

TEMPORARY, for the time being.

TENDON, the fibrous end of a muscle by which it is attached to the part it is intended to move.

TISSUE, the substance of which organs are composed.

TOXIN, a poison excreted from the body of, or formed by, an organism.

TRACHEA, the wind-pipe.

TRITURATE, to grind up.

TRYPSIN. The active Ferment of the secretion of the pancreas which changes starch to sugar.

TYRO-TOXICON, an organic toxin or poison sometimes developed in milk, butter, cheese, etc.

VALVE, a fold of membrane which permits the passage of fluids or solids in one direction only.

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HENRY KIMPTON, 13 FURNIVAL STREET, LONDON E.C.